Conceptual Wetland Compensation Plan for Magnuson Park Phase 2 Development Seattle, Washington

COE #200600052

Prepared for:

SEATTLE PARKS AND RECREATION

Prepared by:

Sheldon & Associates, Inc

January 27, 2006

Conceptual Wetland Compensation Plan for Magnuson Park Phase 2 Development Seattle, Washington

COE #200600052

Prepared for:

Seattle Department of Parks and Recreation
100 Dexter Avenue North
Seattle, WA 98109

Prepared by:

Dyanne Sheldon, Principal
Doug Gresham, Senior Wetland Ecologist
Sheldon & Associates, Inc.
5031 University Way NE, Suite 204
Seattle, WA 98105-4341
206-522-1214

January 27, 2006

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

APPENDICES

1.0 INTRODUCTION

The City of Seattle Parks and Recreation Department (Seattle DPD) has undergone an extensive public process to design improvements in Warren G. Magnuson Park with development of a Master Plan for future development (Seattle Parks and Recreation 2001). Seattle DPD has gone through a public Master Planning process several times in the decades since the Park was acquired in 1972 by Seattle Parks and Recreation from the Federal government. The Final Master Plan was approved by the Parks Board and City Council in June 14, 2004 (Council Bill # 114827). This Plan is provided to identify the compensation proposed for the anticipated wetland impacts from Phase 2 actions of the Master Plan.

The 2004 Master Plan identified creation of 11 lighted synthetic turf athletic fields, a natural grass sports meadow and improvements to on-site habitats, including wetlands, within the Park. Through various political and environmental review processes, the total number of fields was reduced. The final Master Plan approved a Sports Meadow and up to 9 athletic fields, 7 of which may be lighted.

The Master Plan identified multiple Phases of work to complete all elements of the Plan. Phase 1 was the Sports Meadow constructed in 2004-05, to be in use by 2006. Phase 2 of the Master Plan is the subject of this compensation plan; it is designed to be a "stand alone" project in terms of park use and environmental function, even if no future phases of the park master plan can be pursued. The proposed action under the Phase 2 development will occur on an approximately 95-acre portion of Magnuson Park. The proposed action involves creating athletic fields and associated infrastructure (e.g., stormwater conveyance facilities), and creating and enhancing wetland and upland habitats.

Phase 2 is currently funded with funds from the Seattle Pro-Parks Levy plus additional funding sources. At this point in time, no future public funding for subsequent phases of the Park Master Plan have been identified. Therefore, the actions and compensation proposed within this report are considered as one separate and complete project because there is no funding identified for any future phases of the Master Plan.

This compensation report provides the following:

- an overview of existing conditions,
- a description of actions proposed for the Phase 2 athletic fields,
- a description of the impacts associated with the athletic fields in Phase 2,
- a description of the proposed compensation for anticipated impacts
- a proposed monitoring plan for the habitat areas within Phase 2, and
- a long-term management plan for the habitats within the Park.

Phase 2 will impact 6.0 acres of wetlands due to filling and changes in hydroperiod. It is proposed to create just over 10 acres of new wetland and enhance just over 4 acres of existing wetlands to compensate for anticipated impacts. All existing wetlands within the project area are Category III (Ecology/City of Seattle rating systems), except one Category IV wetland. The majority of the wetlands are closed depressions, dominated by native and non-native grasses and forbs with some patches of native shrub and sapling/forest communities present. The wetlands in the project area have a seasonal hydroperiod, becoming shallowly inundated by winter rains and drying out completely by late spring of each year. Due to severely compacted soils on the site, it is assumed that no groundwater infiltration or groundwater movement between wetlands occurs in existing conditions.

The goals for the habitat parameters of the proposed project are:

- to preserve the hydroperiod of existing wetlands that are to remain on the site and maintain the general movement of water across the site;

- enhance the functions of remaining wetlands within the project area through passive and active means such as increasing the depth/duration of hydroperiods, increasing native species richness, removing and controlling invasives, increasing physical complexity, and improving conditions in adjacent habitats;
- maintain or improve the physical connectivity between habitats on the site;
- create new wetlands with a diversity of community types and HGM-types out of existing low-quality upland habitats;
- improve water quality conditions draining into Lake Washington by removing 12 acres of impervious surface, appropriately treating stormwater runoff from some paved surfaces which is untreated in existing conditions;
- provide improved access for education and passive interpretation of the various habitats and water features in the project area.

Wetlands within Magnuson Park are subject to City, State and Federal regulations. This report is intended to meet the reporting requirements for the Seattle Department of Planning and Development, Washington State Department of Ecology for the provisions of Section 401, and for the Army Corps of Engineers (COE) of Section 404 of the Clean Water Act.

1.1 Project Location

Magnuson Park is located in the City of Seattle, King County, Washington (Figure 1). It is located in the northeast corner of Seattle on a peninsula surrounded by Lake Washington (Figure 2). The Park lies in Section 2, Range 4 East, and Township 25 North. Magnuson Park is bordered on the west by Sandpoint Way NE, along the south roughly by NE 65^{th} Street (a portion of the Park lies south of NE 65^{th} if it was extended to the lake shore), on the east side by Lake Washington, and to the north by the National Oceanic and Atmospheric Administration (NOAA) facilities. Magnuson Park is a 350-acre park managed by the City of Seattle that contains historic Naval Air Station structures, athletic fields, a dog off-leash area, playground, parking lots, walkways, stormwater conveyance facilities, and habitat areas.

1.2 Responsible Parties

Responsible Agency
City of Seattle Department of Parks and Recreation
100 Dexter Avenue North,
Seattle, Washington 98109
Jon Jainga, Project Manager
(206) 684-7054

Authors of Wetland Compensation Plan
Dyanne Sheldon, Principal
Doug Gresham, Senior Wetland Ecologist
Sheldon & Associates, Inc.
5031 University Way NE, Suite 204
Seattle, Washington 98105
(206) 522-1214

1.3 Project Description

The following information describes the proposed Phase 2 actions in the Park. Additional information on the project is provided in the Biological Evaluation prepared for the project (Sheldon & Associates 2005a). Figure 3 illustrates the Phase 2 area within Magnuson Park. Accompanying this text report are detailed drawings of the Phase 2, as larger 15"X 22" sheets. See Sheet L-0.01 for the Phase 2 Site Plan.

The Phase 2 project includes:

- constructing 4 athletic fields and the sub-grade for 1 future field;
- re-alignment of the cross-park trail and creation of new walking trails between the fields and habitat areas;
- improvement of habitats within the project area

The proposed field and trail projects are described in this Section; the discussion of the proposed changes in habitats comprises the remainder of the report.

Athletic Fields

It is proposed to construct 4 athletic fields and the sub-grade for one additional field for this project. All the fields for this project will be constructed by filling to raise the fields above existing grades in order to provide positive drainage for the fields and to provide water to the down-gradient wetland habitats. When describing or discussing the aerial extent of a field it is the footprint of the field surface (i.e., the full extent of the area necessary to fill to create the sub-base on which the playing surface is laid out) is used. See Figure 4 for the configuration of the fields as described in this Report. A description of proposed Lighting standards and details is provided at the end of this Section of this report.

Field #5: Rugby

This field will be natural grass, with the possibility of a synthetic turf upgrade dependant on budget availability. The total footprint of approximately 503 feet by 282 feet includes the limits of grading for the field playing surface plus, adjacent trails. The field will be lit for evening and night. Parking for this field will be provided in the existing paved parking area to the northwest which currently serves the Jr. League playground and Off-leash area. If the field is natural grass, it will be irrigated if natural grass, it will not be irrigated if its synthetic turf. The field, regardless of surface type, will be constructed with an under-ground drainage system that will collect surface water (from storm events or from irrigation) and discharge it at mid-field along the field's southern edge through a single outfall. The outfall pipe will discharge stormwater to a low-slope swale that flows to existing wetland E-1. If natural grass, it will be managed for grass quality by utilizing the City of Seattle Turf Best Management Practices for application of fertilizer, herbicides, and pesticides. Those BMPs specifically call-out that if a field is within 50 feet of a stream or in the vicinity of a wetland, no fertilizers are to be used. For a synthetic surface, no such chemical applications will be used for maintenance.

Field #1: Soccer

This field will be synthetic turf, with a total footprint of approximately 419 feet by 340 feet including limits of grading, adjacent trails, etc. The field will be lit for evening and night use. Parking for the field will be provided in the existing paved parking area to the northwest. The field will not be irrigated. The field will be constructed with an under-ground drainage system that will collect surface water (from storm events) and discharge it at the southeast corner of the field with through a single outfall. The outfall pipe will discharge to a stormwater impoundment area that is being created within an existing wetland. From the impoundment area, the water will discharge via a leaky berm to another part of the same existing wetland.

Field #3: Soccer (Field sub-grade)

This phase includes the establishment of sub-grade for field # 3. Construction of the field itself is not fully funded and may or may not be included in this phase dependant on additional fundraising. The sub grade will have a footprint of approximately 360 x 420 feet. If completed, the playing surface will be grass or synthetic turf. The field will be lit for evening and night use. Parking for this field will be provided in the existing paved parking area to the northwest. The field will be irrigated if it's natural grass, but not irrigated if it is synthetic turf. The field sub-grade will sheet flow to the east and south, similar to existing conditions and sheet flow patterns. If constructed, the field will have an under-ground drainage system that will collect surface water (from storm events or from irrigation) and discharge it along the east and south edges of the field through three outfalls, to help distribute flows to different areas of the existing wetland. One outfall would be at the northeast corner of the field, a second outfall would be at about midfield on the east side, and a third outfall would be to the south at the field's southeast corner.

Field 6: Fast-pitch Baseball

This field will have a natural grass outfield with a synthetic turf infield (the outfield may be upgraded to a synthetic turf dependent on budget availability). This field will have an approximate footprint of approximately 444 feet by 400 feet including limits of grading, adjacent trails, etc. The field will not be lit. Parking for this field will be provided in the existing paved parking area to the south, north of 65th Street. Natural grass portions of the field will be irrigated, but not irrigated if synthetic turf. The field will be constructed with an under-ground drainage system that will collect surface water (from storm events or from irrigation) and discharge it from a single outfall pipe to the wetland area east of the field.

Field 9: Little League/Softball

This field will have a natural grass outfield with a synthetic turf infield (the outfield may be upgraded to a synthetic turf dependent on budget availability). The field will have an approximate footprint of 327 feet by 292 feet including limits of grading, adjacent trails, etc. The field will be lit for evening and night use. Parking for this field will be provided in the existing paved parking area to the south, north of 65th Street. Natural grass portions of the field will be irrigated, but not irrigated if synthetic turf. The field will be constructed with an under-ground drainage system that will collect surface water and discharge it to the southeast through a single outfall to the entry pond wetland area.

Field Lighting

Those fields identified to be lighted for evening and night use would be lit from dusk until 10:00 PM Monday through Saturday at most, with no lighting on Sundays. Actual use of field lights will be variable, based on time of year and scheduling considerations. The fields will only be lit when reserved for scheduled athletic events. Lighting technology will be either shielded conventional lighting or full cut-off lighting based on field lighting requirements and a balanced approach to minimizing spill light, glare and sky glow.

Trails

In existing conditions, Magnuson Park has an intricate network of formal and informal walking trails throughout the Park. Historic use of the entire site as a Naval Air Station left the site with remnant pervious features (e.g., portions of taxiways and runways, perimeter roads, etc.) that are used as *de facto* trails. In addition, decades of public use has resulted in a complex network of informal dirt paths throughout the interior portions of the Park. The Park is used extensively by the public; it is extremely rare to be on this site and not observe public use of the formal and informal trail system.

The proposed action under Phase 2, will formalize a perimeter trail linking north to south across the interior portion of the site. The trail will be handicap accessible and will provide for overlooks into the interior of the improved habitat zones. Overlooks will be provided on the west side of the habitat zone on a large created berm, and to the Promontory Point wetlands and marshes to the north, with a trail and dead-end node entering from the north.

The proposed trail system will also include access to the range of habitat types on the site for educational purposes. The trail is designed to provide access only along the periphery of the habitat zones. Trails will provide access to various wetland types including easy access to surface water for sampling opportunities. At the same time, the trail system will be designed to limit access to interior portions the habitat zones. Based on input from the public and wetland scientists, there are no trails proposed within the interior habitat zones. The interior habitat areas are the heart of the habitat zone, free of human activity, eliminating many of the current informal trails. A trail will be created between the Promontory Point wetlands and 65th Street in the southeast corner of the project area to allow pedestrian access through various habitat types and to remove pedestrian movement from 65th Street. See Figure 4 for the trail layout.

Parking and Roads

Phase 2 actions do not include creating new parking areas or roads within Magnuson Park. It does include the removal of underutilized dead end roads and old airport tarmac in the interior of the project. Existing parking facilities and road infrastructure will be utilized for parking for the new fields. Sportsfield Drive and Beach access road will not change in their configuration. The alignment of 65th will also remain unchanged, however some conditions along the northern edge will be improved. Improvements include establishing clear access points to the existing parking lot, as well as collecting stormwater using surface conveyance. The stormwater will flow through a filter strip and vegetated swale, or through an ecology embankment (vegetated strip) for pre-treatment, and then will be directed to the wetland. This system replaces existing catch basins and pipes that collect stormwater off the paved surfaces and convey it to the main storm drain trunk line that discharges untreated, to Lake Washington. This is discussed in more detail in Section4.0, Mitigating Measures.

1.4 Wetland Delineation

The highly disturbed nature of the Magnuson Park site necessitated a collaborative effort with agency staff at the U.S. Army Corps of Engineers (COE), Washington Department of Ecology (Ecology), and City of Seattle in developing the wetland delineation methods. Sheldon & Associates (S&A) collaborated with these agencies through a combination of site visits and written correspondence (Sheldon & Associates 2005b) to reach a consensus on the methods that would be used to delineate wetlands. The conclusions of the wetland report were approved by City of Seattle, Ecology, and Army Corps of Engineers staff in November, 2005.

Wetlands were identified using the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Washington State Wetlands Identification and Delineation Manual* (Washington Department of Ecology 1997). Methods used to identify wetlands included the Routine Determination, a modified Comprehensive Determination, and a statistical approach method. A detailed discussion of the methods used and the results of the wetland delineation are provided in the *Magnuson Park Wetland Delineation Report* (Sheldon & Associates 2005c), available on the City of Seattle Pro-Parks Magnuson Park web site at: http://www.ci.seattle.wa.us/parks/proparks/projects/MagnusonWetlandReport8-16-05.pdf

The delineation was conducted within the Master Planning area, of which the Phase 2 area is a sub-set. Approximately 29.84 acres of wetlands were identified within the Master Planning area examined in Magnuson Park. There are 25 wetlands identified using the Comprehensive Determination Method; these 25 included within them 10 wetlands delineated using the Routine Determination method, 3 ditches were also delineated using the Routine Method, and a small amount of acreage was identified as wetland using a Statistical Approach method. The majority of the wetlands identified in the Master Planning area are Category 3 using the Western Washington Rating System by Ecology (2004a), which is used both by the City of Seattle and Ecology to rate wetlands for regulatory purposes.

Figure 5 illustrates the 29.84 acres of wetland that were identified in the Master Planning area. See Sheet L-4.00 of the large format drawings for the Polygon and wetland configurations. For this report, only those wetlands within the Phase 2 project area will be discussed. Table 1 summarizes the acreages of estimated wetland areas, the ditch segments, and delineated wetlands within the Phase 2 area. Table 2 summarizes the wetland ratings, (using the Ecology rating system), hydrogeomorphic classification, USFWS classification, and City of Seattle rating system. Representative photographs of both wetland and upland habitat in the Phase 2 area are provided in Appendix A.

More detailed information and analysis of existing conditions, including wetlands is provided in Section 3.0, Ecological Assessment of Existing Site.

Table 1. Summary of Wetlands in the Phase 2 Project Area.

Polygon Area	Wetland Name	Delineated Wetland Area (acre)	Estimated Wetland Area (acre)	Statistical Approach Wetland Area (acre) [a]	Total Wetland Area (acre)
B				0.14	0.14
	B1		1.63		1.63
	B2		0.33		0.33
	B3		0.48		0.48
	B4		0.27		0.27
C	C1		0.34		0.34
D	D1		0.06		0.06
E				0.65	0.65
	E1		8.55		8.55
	E2		0.70		0.62
	E3		0.72		0.72
M				0.57	0.57
	M1		0.33		0.33
	M2		0.43		0.43
	M5		1.39		1.39
	M6		0.96		0.96
	Ditch 4B	0.08			0.08
Sub-total		0.08	15.39	1.36	
TOTAL					**16.83**

[a] Area estimated within polygon from data plots not located within either an estimated or delineated wetland.

Table 2. Ratings and HGM Classes of Wetland Areas in the Phase 2 Project Area

Polygon Area	Wetland Name	Ecology Category [a]	HGM Classification	USFWS Classification[c]	Seattle Classification[d]
B	B1	III	Depressional closed	PEM	Exceptional Value
	B2	III	Depressional closed	PEM	Exceptional Value
	B3	III	Depressional closed	PEM	Exceptional Value
	B4	III	Depressional closed	PEM	Exceptional Value
C	C1	IV	Depressional closed	PEM	Degraded
D	D1	III	Depressional closed	PEM	Exceptional Value
E	E1	III	Depressional closed	PFO/PSS/PEM	Exceptional Value
	E2	III	Depressional open	PSS/PEM	Exceptional Value
M	M1	III	Depressional closed	PFO/PEM	Exceptional Value
	M2	III	Depressional closed	PSS/PEM	Exceptional Value
	M5	III	Depressional closed	PSS/PEM	Exceptional Value
	M6	III	Depressional closed	PFO/PSS/PEM	Exceptional Value
	Ditch 4B	III	Riverine flow through	R4UB	Degraded

a = Ecology classification based on Ecology (2004a).
b = HGM classification based on Brinson (1993).
c = USFWS classification based on Cowardin et al. (1979)
d = Seattle classification based on City of Seattle Municipal Code (Seattle 2005).

2.0 PROJECT IMPACTS

The Phase 2 project involves creating athletic fields, trails, and preserving, enhancing, and creating wetland and upland habitats. There will be direct, indirect, and operational impacts to wetlands as a result of construction and operation of the Phase 2 development. The impacts are described below. Measures to mitigate adverse impacts are in Section 4.0, Mitigating Measures, proposed compensation actions are described in Section 5.0, Compensation Plan.

Phase 2 development of Magnuson Park will directly impact wetlands through filling and changing their hydrologic regime. Indirect impacts may occur from, changes in hydroperiod and potentially changes in water quality entering wetlands. Operational impacts may arise from changes in human uses of the site, increased human activity in proximity to habitat areas, and field lighting regimes.

The site, in existing conditions, is relatively flat, as a result of its previous use as a Naval Air Station airfield. Gradients are incredibly gradual across the site, grass growth patterns occur on 'extreme' hummocks of up to 12" in height, and old ditches and pathways through the site strongly influence sheet flow across the site. Survey work on site is based on spot elevations. Wetlands do not always follow the logic of topography in existing conditions (e.g., wetland boundaries cross up and across topographic divides; wetlands 'head' uphill, etc). However, for impact assessments, we have assumed that the existing topography is accurate and proposed grade changes of 1 foot or more may cause changes in existing wetland hydroperiods. When topography was uncertain, a very conservative interpretation was taken to assure wetland impacts were not under-represented.

Mitigating measures were taken to avoid wetland impacts by locating fields on the western margins of the Master Planning area, by placing fields at a higher elevation to promote runoff for 'driving' wetland hydroperiod, by using state-of-the art lighting systems to minimize lighting affects. Mitigating measures are described in detail in Section 4.0 Mitigating Measures.

2.1 Direct Impacts

The proposed action will directly impact 6.00 acres of wetlands due to filling and substantial adverse changes in hydroperiod. Impacts to existing wetlands have been calculated for areas where no fill is proposed, but where grading in the immediate vicinity has the potential to so significantly adversely affect wetland hydroperiods that wetland functions may be diminished or lost. A summary of direct impacts, by wetland, is provided in Table 3. See large format Sheets L-4.01, L-4.02, and L-4.03 for an illustration of proposed wetland impacts.

Wetlands will be directly impacted by creation of athletic fields, trails, trail overlooks, and the grading necessary to create the appropriate drainage patterns on the site to maintain wetlands that are outside of Phase 2 work limits. Direct impacts will result in direct fill of 5.42 acres in eleven wetlands (B1, B2, B3, B4, C1, D1, E1, E2, M2, M5, and M6) and one ditch (4B). In addition, an estimated acreage of 0.58 acres of impact has been calculated in Polygons B, E, and M to reflect the estimated acreage of wetland present within the polygons identified using the statistical approach (see the 2005 Wetland Delineation report).

Examples of the areas where impacts were calculated based on an assumed change in hydroperiod are in the southeast 'corner' of the Phase 2 project area. Grading activities here will cause water to be directed into and through two different wetlands (M6 and Ditch 4-B) causing some existing wetland areas to be left 2 feet above future wetland elevations. Habitat design in this area was driven by a goal to create more wetland but to not grade a healthy copse of young robust black cottonwood saplings. Because future wetland grades will be lower than the existing wetland for some portions of it, we have assessed these areas as 'direct' loss. See Figure 6 for an illustration of direct impacts associated with Phase 2.

Table 3. Summary of direct wetland impacts from Phase 2 Magnuson Park

Wetland	Impact Area		Causes of Impact
	Square foot	Acre	
B1	49,020	1.13	Filling for athletic field
B2	14,200	0.33	Filling for athletic field
B3	20,952	0.48	Filling for athletic field
B4	1,008	0.02	Filling for athletic field
Polygon B	6,098	0.14	statistical estimate: fill for fields
C1	14,972	0.34	Filling for athletic field
D1	2,649	0.06	Filling for athletic field
E1	98,151	2.25	Filling for athletic field

E2	18,975	0.43	Filling for athletic field
Polygon E	14,157	0.33	Statistical estimate: fill for fields
M2	5,301	0.12	Filling for trail features
M5	2,546	0.06	Change hydroperiod from grading
M6	6,966	0.16	Change hydroperiod from grading
Polygon M	4,966	0.11	Statistical estimate: fill for fields
Ditch 4B	1,399	0.03	Change hydroperiod from grading
Total	261,360	**6.00**	

2.2 Indirect/Operational Impacts

Indirect/operational impacts to the habitats on the site may be a result of changes in the human uses (e.g., increase in numbers of people on the site, changes in the timing/duration of people on site, change in traffic, etc.), changes in water quality on the site (e.g., grassed field runoff, day-lighting buried storm drains to run stormwater through treatment facilities), or field lighting affects.

Creation of new athletic fields will result in an increase in the number of cars on the Parks' roads and parking lots, as well as an increase in the number of people on the site. Placement of the fields along the western boundaries of the habitat area will place light and sound impacts near habitat areas that do not exist in current conditions. Increased vehicular and human activity may have affects on the wildlife that utilize the adjacent habitats. As noted in the EIS (Seattle Parks and Recreation 2001) the project will result in shifts in the habitats provided on the site, with an accompanying shift in the wildlife species using those habitats. It is assumed that species that utilize the habitats adjacent to the areas of high vehicular and human traffic will be those that have a higher tolerance for those human-associated activities, such as European starlings, Northwestern crows, rock doves, etc.

Increased vehicular use of the internal roads and parking lots may result in an increase in contaminants associated with stormwater runoff from those areas. Such contaminants may include copper (from brake pad wear), zinc (from motor oils and hydraulic fluids), and hydrocarbons related to vehicle use. In existing conditions, stormwater runoff from internal roads and parking lots either sheet flows off of the existing surfaces into the habitats untreated, or the stormwater is collected by the existing old storm-drain system and it is discharged directly to Lake Washington untreated.

Runoff from the athletic fields is not expected to result in changes in the water quality entering the wetlands on the site. No project-related water quality impacts associated with the artificial turf playing fields are expected in Lake Washington. Artificial turf fields use a type of rubber for the infill, in combination with fibers (polyethylene, polypropylene, nylon, etc.) to help hold the infill in place. Often, the infill rubber is derived from recycled material, including vehicle tires and athletic shoes. The rubber is referred to as 'cryogenic rubber', as the rubber is first frozen and then broken into spherical pieces, removing any sharp edges in the process.

Concerns regarding potential leaching of infill into water percolating through such material have been raised in the past, and studies have concluded that leaching of pollutants does not occur, or occurs at negligible levels (i.e. well below background pollutant levels). No known water quality issues are associated with water moving over the inert fibers of athletic fields. Liu et al (1998) presents a review of studies conducted to assess the potential for leaching of metal and organic pollutants into water moving through rubber fill associated with a variety of different civil engineering projects. Generally, all of the pollutants of concern occurred at levels below drinking water regulatory standards as water moved through the rubber fill. Although instances of pollutant loading were seen, these all occurred under conditions of extreme pH levels (metals leached under very acidic conditions, organics leached under very basic conditions). Water at the Magnuson site will not exhibit extreme pH levels, and no leaching of pollutants into water percolating through the athletic fields is anticipated. According to King County, industrial-grade glue is used to seams in synthetic fields; no known environmental impacts are associated with the use of glue in synthetic athletic fields.

It is not expected that changes in hydroperiod will be an adverse affect of the project. Both types of fields (natural grass and synthetic turf) are underlain by a sand or gravel base (depending on the field surfacing). Beneath the field base material, there is a sub-surface drainage network of perforated pipes trenched into the field sub-grade and bedded in washed gravel. The field base and drainage bedding materials allow drainage of the fields by vertical percolation. The rain or irrigation water that falls on each field will filter through the base and bedding materials to the drainpipes. The effect is a slow release of the water from the fields to the onsite wetland drainage system. In existing conditions, the site soils are so compacted that precipitation does not infiltrate adequately into site soils. Instead it sits on the surface and sheet flows across the site (between hummocks and within ditches) following the gradient. Thus, there is no storage of shallow groundwater in the near-surface profile that one would normally expect in more typical undisturbed soils. When the rains end, surface waters leave the site through evaporation, evapotranspiration, and modest sheet flow; the site dries out completely by early summer. It is expected that the percolation zones under the surface of the fields will actually function to prolong wetland hydroperiods slightly. They will hold and discharge waters for a longer period of time after the rains end in spring than the existing highly compacted conditions.

Field lighting impacts are considered an Operational Impact because changes in schedule or operations can influence the extent or degree of potential impact. Impacts from lighting may include negative effects to amphibians and birds; such effects may include disruptions to breeding cycles of nocturnal frogs, disruption to the activity and foraging cycles of birds, and the potential for confusing or artificially attracting migrating birds.

3.0 ECOLOGICAL ASSESSMENT OF EXISTING SITE

An ecological assessment of the Phase 2 project area is provided below. The proposed action will change existing wetland and upland habitats, convert existing disturbed areas into functioning habitat, and preserve areas of habitat. A general overview of existing habitats and uplands is provided below. A more thorough assessment of the existing wetlands on the project site follows in this Section.

3.1 Existing Habitats Overview

Warren G. Magnuson Park contains a variety of habitats in existing conditions. Prior to lowering Lake Washington in 1916, and the subsequent major alterations to create the Sand Point Naval Air Station in the early 1930's (see Figure 7), the site contained upland forests and a large wetland complex. Since the decommissioning of the Naval Air Station, large portions of the site have become recolonized by native and non-native species forming a variety of habitat types, see Figure 2. Decommissioning of the Air Station resulted in removal of most of the airfield surfaces and infrastructure, but not all of it. Internal parking lots, roadways, paved trails and facilities are remnants from the airfield. Demolition of paved areas of the airfield was accomplished in several ways: the pavement was graded and removed; it was graded and stockpiled (used to form the base of Kite Hill); or it was demolished and left in place. These actions have had a strong influence recolonization of plants and on the resulting habitats that have formed on the site.

Because the interior of the site was an airfield, the existing grades are unnaturally flat. Soils are extremely compacted throughout much of the habitat zones of the site due to the presence of the airstrips and the deconstruction methods. As noted in the wetland delineation report, soils are so compacted on the site that soil pits for delineation purposes had to be augured by machine to reach a depth of 16+ inches. This has strongly influenced the resulting vegetation communities that have colonized in the subsequent 30 years.

In 2001, an extensive Vegetation Management Plan (VMP) (Sheldon & Associates 2001) was prepared for Magnuson Park. The plan is available on the web at:
http://www.cityofseattle.net/parks/magnuson/vmp.htm, it should be referenced for a more thorough description and characterization of the existing habitats on the site. The plan describes and characterizes 7 different habitat types within the major habitat zones of the Park. The 7 habitat types identified are:

Non-native Shrub
Upland Forest
Upland Meadow
Tree/Shrub Savannah
Wetland
Wetland Mosaic
Mowed Grassland

The VMP described the general conditions in the Park as:

> *"The… majority of the Park is vegetated by a daunting mix of native and non-native herbs/grasses, shrubs, and trees. Some species, once purposefully planted, now are considered invasive (Lombardy poplars). Other species were not installed, but have colonized and thrived in the severely altered and depleted soils present on the site (Himalayan blackberry and Scot's broom). Some invasive non-natives, such as blackberry, are cherished by some community members during late summer berry-picking season. Others species, such as the Lombardy poplars throughout the center of the Park and the non-native weeping willows along the shoreline, present large canopy masses that impact views from within and outside the Park.*
>
> *Habitat values within the Park are variable. There is great benefit in having such expansive open vegetated park land near the lake margins. However, the lack of native species, the lack of structural elements in the forests, and the paucity of vegetation community types in the Park severely limits the benefits of the existing habitats for a wide array of potential wildlife species.*
>
> *There are biological wetlands within the natural areas of the Park. Expanses of wet meadows, characterized by native and non-native grasses and rushes, are found in the open meadows between the two existing sports-field areas. Multiple small seasonal marshes are present, where surface water collects and stays in pools of 4"-18" in depth, long enough to provide some habitat for amphibians and native freshwater snails. Stands of black cottonwood have established around the margins of some these small impoundments, causing them to shift from emergent marsh communities to shrub and tree dominated wetlands. Upland meadows are still present, although non-native hawthorne and Himalayan blackberry are able colonizers of these areas. Most shrub thickets are dominated by non-native blackberry and hawthorne: both of which provide food source and cover for birds and small mammals. Promontory Point provides the most mature and largest upland forest complex on the site, though smaller stands of black cottonwoods as well as madrone sapling stands also exist."*

3.2 Uplands

Upland habitat within the Phase 2 project includes a mixture of open grassy fields, thickets of native and non-native invasive shrubs, and forested areas. As noted, the habitats are a result of historic land uses and resulting recolonization of the soils exposed after removal of the airstrips.

In the southwest corner of the Phase 2 area between the playfields and Commissary parking lot, uplands contain open fields dominated by non-native grasses and non-native shrub thickets. The dominant plant species in this area include: colonial bent-grass, redtop, quack-grass, thistle, and Himalayan blackberry. There is a stand of aspen trees located near where the Air Station bank was once located. During the wetland delineation field work it was discovered that these aspens are a colony established on 4-6 inches of soil placed above landscaping fabric. It is assumed that the original aspens may have been installed as part of the bank landscaping. An effort will be undertaken to salvage these trees and saplings, if possible, during Phase 2 construction activities.

The northwest corner of the Phase 2 area is an actively maintained athletic field dominated by non-native grasses. The margins of the field area contain rows of non-native ornamental trees and a picnic shelter.

Upland habitat in the north central portion of the Phase 2 area includes an extensive stand of madrone, black cottonwood, paper birch, and red alder. The habitat area is of special interest to citizens and the Park staff because it contains a wonderful 'grove' of madrone saplings that have established immediately adjacent along the margins of the asphalt pavement of the abandoned road/taxiway. This upland forest reflects the highly disturbed conditions within the Park: it has an understory of Himalayan blackberry, Scot's broom, colonial bent-grass, and quack-grass, and an open canopy of madrone, birch, and black cottonwood side-by-side. There is a small wetland (D-1) within the D polygon that includes the upland forest: it's assumed that the wetland is present due to runoff from the Jr. League playground to the north. The upland habitat area is surrounded by paved roads and walking paths.

The northeast corner of the Phase 2 area contains a mixture of grass fields, invasive shrub thickets, and forested stands. The dominant plants include black cottonwood, white poplar, Himalayan blackberry, Scot's broom, colonial bent-grass, and quack-grass.

Upland habitat in the southeast corner of the Phase 2 area surrounding the Commissary parking lot includes invasive shrub thickets, scattered stands of common hawthorn saplings, and open grass fields. There are several large thickets of Himalayan blackberry and Scot's broom, especially bordering the soil stockpile area near the Commissary.

3.3 Wetlands

The existing wetlands in the Phase 2 project area are described in detail in the Wetland Delineation Report (Sheldon & Associates 2005c). The wetlands within the Phase 2 project area are depicted on Sheet L-4.00 of the large format drawings. The general pattern of water movement across the site is depicted in Figure 8.

Provided below is an overview of the specific wetlands that are proposed to be impacted or enhanced by the project. The wetlands, in general, are quite simple in their species composition, sources of water, and functions provided. Because of the land-use history of the site, there is little variation between the wetlands on the site. All of these wetlands have a seasonal water level fluctuation with shallow standing water in the winter (up to 12 inches in depth), to completely dried out by late spring/early summer. All of these wetlands, with the exception of those in Polygon B, exist on severely compacted soils, thus precipitation tends to shallowly pool in the wetlands, then sheet flow off the wetland. Because of the similar nature of these wetlands, the functions that they provide are described at the end of this Section.

<u>Wetlands B1, B2, and B3</u>

Wetlands B1, B2, and B3 are palustrine emergent wetlands dominated by native and non-native grasses. They are closed depressions in hydrogeomorphic class; and rated as Category III using the City of Seattle/Ecology rating system. This zone of the Park was not paved as part of the airstrip, thus the soils are less compacted than other polygons in the project area.

Vegetation

Wetlands B1, B2, and B3 are palustrine emergent depressions dominated by native and non-native grasses. Species present include colonial bent-grass, redtop, common velvet-grass, quack-grass, and slough sedge. See Table in Appendix B for a list of common and scientific names for vegetation species observed on site during the delineation.

Hydroperiod

The primary source of water to Wetlands B1, B2, and B3 is surface runoff from precipitation in the immediate area that perches over compacted soils. Signs of seasonal inundation include standing water, bare ground with no vegetation present, and sediment deposits.

Soils

A total of 63 soil pits were examined during the delineation of Wetlands B1, B2, and B3. A typical profile in a wetland soil pit consisted of an A horizon of 10YR 3/3 sandy silt, a B horizon of 2.5Y 5/1 gravelly clay with mottles, and a C horizon of 2.5Y 4/2 sandy clay with mottles.

Wetlands C1

Wetland C1 is a palustrine emergent closed depression is a Category III wetland. It is located within an old 'intersection' from the historic airstrip road system and is highly disturbed.

Vegetation

It has the highest percent bare dirt of any of the wetlands on the site and the vegetation that is there is dominated by colonial bent-grass, redtop, common velvet-grass, and quack-grass. The eastern edge of the wetland is a blackberry thicket.

Hydroperiod

The primary source of water to Wetland C1 is surface runoff from precipitation perching over compacted soils. Signs of seasonal inundation include standing water, bare ground with no vegetation present, and sediment deposits.

Soils

A total of 11 soil pits were examined during the delineation of Wetland C1. The typical wetland soil pit profile consisted of an A horizon of 10YR 4/2 sandy loam and a B horizon of 2.5Y 5/1 clayey sand with mottles.

Wetlands D1

Wetland D1 is a small palustrine emergent closed depression located just south of the Junior League playground. It is a Category III wetland.

Vegetation

The wetland is surrounded by a mix of native and non-native sapling upland trees including a significant number of madrones. The vegetation within the wetland is dominated by redtop and tall fescue.

Hydroperiod

Wetland D1 receives surface water runoff from the Jr. League playground located to the north. The runoff is conveyed in a culvert underneath a walking path, and it flows through a small swale into the wetland area. Water dissipates as overland flow, evaporation or evapotranspiration.

Soils

A total of 10 soil pits were examined during the delineation of Wetland D1. The wetland soil pit consisted of an A horizon of 5YR 3/2 silt loam, a B horizon of 10YR 4/1 gravelly sand with mottles, and a C horizon of 5Y 5/1 sandy clay with mottles.

Wetlands E1, E2

Wetland E1 is the largest wetland identified in the wetland delineation report. It is proposed to be impacted on the north edge, west central portion, and southern tip. The wetland contains a variety of Cowardin classification types including emergent, scrub/shrub, and forested vegetation communities. Approximately 70 percent of the wetland will be left in tact. Wetland E2 is a palustrine shrub and emergent wetland closely associated with the swale that drains SW of the Phase 1 Sports Meadow. It is a flow-through depressional wetland. Both of these wetlands are Category III wetlands.

Vegetation

The dominant species in the forested communities of E1 include black cottonwood, Sitka willow, paper birch, and common hawthorn. Colonial bent-grass, redtop, tall fescue, quack-grass, orchard grass, common velvet-grass, soft rush, Baltic rush, and reed canarygrass dominate the emergent vegetation communities. Shrub and emergent community types will be impacted in Wetland E2 including black cottonwood, Sitka willow, redtop, tall fescue, soft rush, Baltic rush, and reed canarygrass.

Hydroperiod

Wetland E1 is a closed depression hydrogeomorphic type meaning that it collects precipitation and sheet flow from the catchment that surrounds it. Water sheet flows into the wetland because it perches over compacted soils rather than infiltrating. Wetland E1 slopes to its southern tip where runoff is confined by roads, thus water is slightly deeper in the southern end. Signs of seasonal flooding in E1 include standing water, sediment deposits, watermarks on trunks, and algal mats.

Wetland E2 receives water from a drainage swale west of the Sports Meadow, that flows down from the north. It also collects sheet-flow from its surrounding catchment area. This drainage swale is the former outlet of what was the engineered sub-drainage system of the Sports Meadow located to the northwest. The Sports Meadow was modified in Phase 1 so that the field now drains to the east however this swale still collects water from its catchment area.

Soils

A total of 160 soil pits were examined during the delineation of Wetlands E1 and E2. Although the profiles in this many soil pits varies, the typical wetland soil pit in Wetland E1 consisted of an A horizon of 10YR 3/2 silt loam and a B horizon of 2.5Y 4/1 sandy clay with mottles. The soil profile in Wetland E2 consisted of A horizon of 2.5Y 4/2 gravelly sand and a B horizon of gleyed (4/5B) clay.

Wetlands M1, M2, M5, M6

These wetlands are all Category III wetlands, with a variety of Cowardin classification types. Wetland M1 is a palustrine forested and emergent wetland; M2 has both emergent and shrub communities; M5 too has emergent and shrub communities; and M6 is the most complex of these wetlands with forested, shrub (sapling) and emergent vegetation communities present.

Vegetation

M1 vegetation that will be altered through creation of the marsh ponds includes black cottonwood, Sitka willow, common hawthorn, and soft rush. Within the shrub and emergent zones, the existing vegetation in Wetland M2 that will be impacted includes common hawthorn, Himalayan blackberry, colonial bent-grass, redtop, and plantain.

Portions of Wetland M5 will be converted to other wetland types. The vegetation in these areas includes black cottonwood and Sitka willow in the shrub zones, and colonial bent-grass, redtop, tall fescue, common velvet-grass, curly dock, and soft rush in the emergent zones. Portions of M6 will also be altered to convert wetland types. The vegetation that will be effected in the shrub communities includes black cottonwood, western red cedar and in the emergent communities species include colonial bent-grass, redtop, meadow and common velvet-grass.

Hydroperiod

Sources of water to Wetlands M1 and M2 are precipitation and sheet flow from their surrounding catchments. Both of these wetlands are closed depressions where water collects over the impervious soils and simply sheet flows out when precipitation levels overtop the shallow basins. Wetland M5 is not a closed depression, waters that enter the wetland from precipitation and the surrounding catchment, exit the wetland as surface flows through a culvert under the Beach Drive paved road. Unlike the other wetlands in the M polygon, Wetland M6 has surface flows that enter the wetland from runoff from 65th Street, as well as precipitation and catchment sheet flow. All of these wetlands have an annual hydroperiod that results in shallow standing water in the winter, and summer drying out completely. Signs of seasonal water level fluctuation include standing water, bare ground with no vegetation present, watermarks on tree trunks, and algal mats.

Soils

A total of 168 soil pits were examined during the delineation of Wetlands M2, M5, and M6. The typical wetland soil pit in Wetland M2 consisted of an A horizon of 10YR 4/2 gravelly sand and a B horizon of 2.5Y 5/2 sandy clay with mottles. The soil profile in Wetland M5 consisted of an A horizon of 2.5Y 5/1 gravelly clay and a B horizon of 5/N gleyed clay. The typical soil profile in Wetland M6 consisted of 10YR 3/2 gravelly clay and a B horizon of 5Y 5/1 sandy clay.

Wetland Functions

The functions of wetlands delineated in the Phase 2 area of Magnuson Park were assessed using *Methods for Assessing Wetland Functions, Volume I* (WFAM) by the Washington State Wetland Function Assessment Project (Hruby et. al. 1999). The Washington State method uses the hydrogeomorphic classification system (Brinson 1993), which sorts wetlands based on landscape position and water regime. The WFAM functional assessment method is based on the presence/absence of physical characteristics of a wetland (or its surroundings); those physical characteristics are used to assume the provision of 15 chemical, biological, or physical functions. Functions are rated on a scale ranging from 1 to 10 (Hruby et al. 1999) which compares the wetland being assessed to reference wetlands that were assessed at the time of the development of the method.

At the time of the wetland delineation report preparation, the WFAM was applied to the wetlands on site with the assumed HGM classes as identified in the delineation report. Subsequently, in the process of spending more time on the site in the winter, and in the comparison of existing to proposed conditions, we have revised the HGM class assumption for the closed depression wetlands.

This change was based on a more accurate assessment that the shallow depressions on this site function more like open depressional systems, than closed depressions once they fill up with early winter rains. The shallow wetlands fill, over-top, and simply continue to sheet flow across the flat surrounding landscapes.

They do not function as closed depressions, where flows are entrapped or retained for long time periods. Nor do they have restricted outlets that cause water to be impounded and then released after a storm event. For all intents, once they fill with water in the fall, they are flow through systems. This change in HGM type then results in the use of a different WFAM model (depressional open vs. depressional closed), and therefore the difference in the resulting scores summarized in Table 4, below.

Water Quality Functions

The depressional open wetlands (B1, B2, B3, B4, C1, D1, E1, E2, M1, M2, M5, and M6) scored 3-4 for the potential for removing sediment because they are shallow and fill-up each winter and water sheet flows through them. Ditch 4B scored 5 as a riverine flow-through wetland. Wetlands with very shallow water depths and unconstricted outlets score low for this functions because they don't detain sediment-laden waters for as long nor allow for as much deposition of particles.

The score for the potential for removing nutrients was 1 for the depressional open wetlands (B1, B2, B3, B4, C1, D1 E1, M1, and M2) due to their inability to detain flows and lack of woody vegetation. M5 and M6 scored 2 based on their size and the presence and amount of woody vegetation in them. Ditch 4B scored 5 for the potential for removing nutrients. Ditch 4B is a riverine flow through wetland it scored higher than the depressional open wetlands because of its vegetative cover and constricted outlet.

The potential for removing heavy metals and toxic organics was calculated as 3 for all the depressional open wetlands (B1, B2, B3, B4, C1, D1, E1, M1, and M2) due to dominance of herbaceous plant species. The scores for E2, and the riverine flow through wetland (Ditch 4B) were both 5 based on the presence woody plant species that strongly influence the uptake or locking up of toxicants and constricted outlet (Ditch 4B) that increases retention.

Water Quantity Functions

The potential for reducing peak flows and downstream erosion in some of the open depressional wetlands (B1, B2, B3, E1, E2, and M1) was given a score of 3 due to their shallow basins, unconstricted outlets and flow-through nature. These same wetlands all scored 4 for the potential for reducing downstream erosion was rated due to the presence of an unconstricted outlet and therefore the reduced ability to influence storage of surface water. Wetlands M5 and M6 rated slightly higher for peak flow reductions and reducing downstream erosion due to the presence of woody vegetation and configuration. Ditch 4B was rated as 7 for reducing peak flows and 6 for reducing downstream erosion based on its water storage capacity with a constricted outlet and the extent of woody vegetation.

The potential for recharging groundwater in all the wetlands in Phase 2, except M2 and M3, were scored as 1 compared to the WFAM reference wetlands. The low rating for groundwater recharge for these wetlands is based on the presence of extremely compacted soils that do not allow for infiltration. Wetlands M2 and M3 had slightly better soil conditions. During the delineation (2005) standing shallow surface waters were often found above bone-dry subsurface soils with only minor (a matter of a few inches) of saturation into the soils. Water that might infiltrate is linked directly to the waters of Lake Washington and not to groundwater per se, therefore the 'function' of groundwater recharge of these wetlands was considered negligible.

Habitat Suitability Functions

General habitat suitability scores for all wetlands ranged from 0 to 4 compared to the WFAM reference wetlands. The lowest ratings (0-2) occurred in emergent wetlands (B1, B2, B3, B4, C1, D1,and M2, and Ditch 4B) due to the lack of woody vegetation, the dominance of non-native grasses and forbs, the lack of snag and large woody debris, and shallow depths on inundation. Higher scores (3-5) occurred in scrub/shrub and wetlands with saplings and groves of trees (E1, E2, M1, M5, and M6) based on more plant strata layers, native species composition, physical complexity and overall wetland size.

Invertebrate suitability scores for all wetlands also ranged from 0 to 4 compared to the reference wetlands. The lowest scores (0-2) occurred in wetlands that lacked long-duration standing water, large woody debris, and different substrate types (B1, B2, B3, B4, C1, D1, and M2). Slightly higher scores (3-4) occurred in wetlands that contain standing water, sapling/tree closed canopy cover, and/or some woody debris features (E1, M1, M5, and M6).

The amphibian suitability rating ranged from 0 to 1 in all wetlands due to the lack of permanent or long-term standing or open water, lack of egg-laying structures (thin stemmed vegetation in standing water), and the paucity of large woody debris.

The anadromous fish and resident fish suitability ratings were not calculated for any of the wetlands in Phase 2 due to lack of any access for fish.

The wetland associated birds suitability scores ranged from 1 to 4 in all wetlands compared to the reference wetlands. The lowest scores (1-2) occurred in emergent wetlands (B1, B2, B3, B4, C1, D1, and Ditch 4B) due to lack of appropriate invertebrate habitats and lack of amphibians in these wetlands. Slightly higher scores (3-4) occurred in wetlands (E1, E2, M1, M2, M5, and M6) that contain woody vegetation, moderate interspersion of vegetation classes (edge habitat), and seasonal standing water.

The wetland associated mammals suitability scores in all wetlands ranged from 0 to 2 due to the lack of permanently flowing water, lack of woody vegetation for beaver, no likelihood of fish being present, and lack of banks for denning. It is known that beaver are active in Lake Washington in the near vicinity, but the Lake is not in the Phase 2 area.

The native plant richness scores ranged from 0 to 2 in all wetlands compared to the WFAM reference wetlands. These low scores are due to dominance by non-native species, moderate interspersion of plant communities, and the condition of adjacent buffers.

The primary production and export function scores ranged from 4 to 7, are moderately high because of the potential of flowing water exiting the wetland. It is our opinion that in existing conditions the scores are unreasonably high because there is extremely limited opportunity to transport organic matter to larger aquatic systems.

Based on professional judgment, the wetlands in existing conditions provide an excellent opportunity for water quality improvement due to the dense persistent grasses that dominate, however there is little to no opportunity for groundwater recharge. Bird habitat is well used by species which prefer open grassy or ‘savannah-like’ conditions, as documented by years of monthly bird counts by Seattle Audubon. In recent years coyote have returned to the Park to compete as effective predators with domestic dogs and feral cats.

Table 4. Functional Assessment Ratings for Existing Wetlands in Phase 2.

Wetland Function Category	Wetland Function	B1	B2	B3	B4	C1	D1	E1	E2	M1	M2	M5	M6	Ditch 4B
Water Quality Functions	Removing Sediment	3	3	3	3	3	3	3	3	4	3	4	4	5
	Removing Nutrients	1	1	1	1	1	1	1	4	1	1	2	2	5
	Removing Heavy Metals & Toxic Organics	3	3	3	3	3	3	3	5	3	3	4	4	5
Water Quantity Functions	Reducing Peak Flows	3	3	3	0	0	1	3	3	3	0	4	4	7
	Reducing Downstream Erosion	4	4	4	0	0	0	4	4	4	1	6	6	6
	Recharging Groundwater	1	1	1	1	1	1	1	1	1	1	2	3	1
Habitat Suitability Functions	General Habitat Suitability	1	1	1	0	1	1	4	3	4	2	3	4	2
	Suitability for Invertebrates	2	2	2	0	0	1	4	2	3	1	3	3	2
	Suitability for Amphibians	1	1	1	1	0	1	1	1	1	1	1	0	1
	Suitability for Anadromous Fish	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Suitability for Resident Fish	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Suitability for Aquatic Birds	2	2	2	1	2	2	4	3	3	3	3	3	2
	Suitability for Aquatic Mammals	2	2	2	1	0	1	2	2	1	1	1	1	1
	Native Plant Richness	1	1	1	0	0	0	2	1	2	0	1	2	2
	Primary Production and Export	5	5	5	4	4	4	5	5	5	5	6	6	7

NA = Not applicable for this wetland in this setting.

4.0 MITIGATING MEASURES

Mitigation is based on a hierarchy of avoiding and minimizing impacts through careful design and compensating for unavoidable adverse impacts (Ecology et al. 1994). “Mitigation”, as defined by SEPA is a required sequence of actions to avoid, minimize and rectify anticipated adverse impacts from a project. Impacts, which are identified as unavoidable, must be compensated for where possible. Impacts (avoidable and unavoidable) were identified in the Sand Point Master Plan EIS which was completed for the Master Plan in 2001 (Seattle Parks and Recreation 2001). The EIS also identified proposed avoidance, minimization, and potential compensatory mitigation actions.

In the detailed design process for Phase 2, care has been taken to avoid and minimize, where feasible, environmental impacts from the proposed athletic fields and trails. Athletic fields are projects which require ‘fixed’ dimensions: each type of field requires specific dimensions for standards of play, including safety considerations. Placement of the fields for this project has been driven by many variables including consideration of lighting impacts, access for existing parking, avoidance of wetlands and protection of significant stands of trees, and anticipated schedule of use.

Provided below is a description of actions taken to avoid and minimize impacts. The remainder of this document describes the proposed actions for compensating for unavoidable adverse impacts from Phase 2.

4.1 Impact Avoidance and Minimization

Efforts to avoid and minimize impacts in Phase 2 involved modifying the proposed design to avoid direct and indirect impacts to wetlands and to existing stands of trees, where possible. Wherever feasible, athletic fields and new trails were placed on existing upland areas and impacts to forests and stands of trees were avoided and/or minimized.

After initial field configurations were identified, a recent aerial photograph of Magnuson Park was used to identify the location of significant stands and individual trees. The approved wetland delineation was used to locate existing wetlands. The proposed field layouts were then assessed on the ground, to identify opportunities for modifying the layouts and/or design details to avoid and minimize impacts.

Specific examples of impact avoidance by field placement are:

- Soccer Field #1 was situated entirely in an upland area currently used as a baseball field.

- Rugby Field #5 was shifted east to minimize loss of existing trees in an upland area near the Jr. League playground. The field was positioned to avoid this stand of madrone and black cottonwood trees along the northwest corner, while also avoiding trees along a slope by the Sports Meadow.

- Soccer Field #3 was shifted to the west as much as possible to avoid impacting Wetland E1, especially the forested area at the southern end. The drainage from this field has been designed to replicate the sheet flow pattern that currently moves southeast through the remaining wetland.

- Baseball Field #9 was rotated and shifted to the north to avoid impacts to Wetland B1. The entry pond between Sportsfield Drive and Baseball Field #9 was also designed to minimize impacts to Wetland B1.

- Baseball Field #6 was shifted north to avoid impacts to Wetland B4, while also minimizing impacts to Wetland E1. Impacts to Wetland B4 were minimized by proposing to use short gabion walls to minimize the footprint of fill necessary adjacent to the proposed entry pond to the south.

- Light fields were situated to avoid, as much as possible, impacts to on-site low income housing (LIHI) and on the habitat zones.

- The design for enhancing Wetland M1 and creating new wetlands in the Marsh Ponds area considered the potential impacts of dewatering wetlands by excavating too close to them or reducing the estimated contributing areas for surface runoff (e.g., a berm will be placed along the southeast edge of Wetland M1 to avoid dewatering this area).

- Impacts to portions of wetlands M4 and M7 were avoided by designing the Marsh Ponds and Promontory Ponds around the outer edge of the forested component of the wetland. In addition, a berm will be placed along the southern edge of Wetland M4 to avoid dewatering this wetland.

Phase 2 design considered the potential impacts of dewatering existing remaining wetlands by excavating too close to them or reducing their estimated catchment areas. In the SE corner of the project area, for example, the proposed created wetland was reconfigured from early concepts, to avoid adversely impacting existing stands of black cottonwood saplings. The grades through this area were carefully considered to not cause dewatering of the existing wetland where possible. Throughout Phase 2, the fields, trails, and overall site grading for water movement and wetland creation/enhancement were all designed, where possible, to avoid and minimize adverse impacts on existing wetlands. To the extent possible, direct wetland impacts from fill and potential impacts from dewatering were avoided or minimized. The resulting configuration of fields and trails still results in wetland fill which is described below.

As identified in the EIS, there will possibly be impacts associated with lighting of the fields, including the potential for glare, spill light, and sky glow. Field locations have been modified to distance the lit fields from residential uses (LIHI) within the Park; upland forests and landscaping specimen have been proposed to be located between lit fields and human residences & wildlife habitats in order to reduce potential lighting impacts over time.

Best Management Practices

Best Management Practices (BMP) and Temporary Erosion and Sediment Control (TESC) measures will be used during construction of Phase 2 to minimize and avoid adverse impacts to on-site wetlands and upland habitats. The following BMP and TESC measures will be required as part of the contract for work on the project, they will be implemented and monitored as part of the construction oversight process.

- Limits of clearing will be fenced and clearly marked prior to any site work;

- Erosion control (silt fencing, straw bales, etc.) will be placed prior to any site clearing to prevent sediment movement into onsite wetlands;

- Construction staging areas will be established on lands which are currently paved on the site. These sites will have designated refueling locations, and a spill prevention and control plan will be prepared and implemented at the outset of construction to minimize adverse impacts from accidental spills;

- All exposed soils that will not be disturbed again will be stabilized by appropriate measures such as hydroseeding, mulching, or sheet-mulching. Habitat and landscape zones will be revegetated within the appropriate time-frames (e.g., late fall or winter); hydroseeding for erosion control may be installed within future habitat zones to stabilize exposed soils prior to installation of native species.

4.2 Unavoidable Impacts

Unavoidable impacts are those actions which will result in the direct filling, or adverse change in hydroperiod, to existing wetlands identified in the 2005 Magnuson Delineation report. Compensation for wetland impacts is proposed as an integral part of the Phase 2 project. Existing wetlands which are proposed to have an increased hydroperiod (depth and/or duration) and/or those proposed to have increased native plant diversity and richness through purposeful enhancement, are not identified as impacts in this report. Proposed compensatory actions for impacts to wetland and upland habitats are described fully in the remainder of this report.

Phase 2 actions will result in 6.0 acres of wetland fill, as shown on Figure 6 and summarized on Table 3 of this report.

5.0 COMPENSATION PLAN

Phase 2 at Magnuson Park involves creation of athletic fields, trails, and modifying the habitats within the Project Area. Historic activities in the region and on the site caused massive alteration of pre-settlement conditions: lowering Lake Washington and construction of the Naval Air Station resulted in massive changes in onsite conditions. Since the decommissioning of the Air Station, 30+ years of natural recovery has resulted in a range of upland and wetland habitats on the 'natural' portions of the Park. Some management of invasive species and installation of native and non-native shrubs and trees has occurred numerous times and in numerous places throughout the Park. The result is a site with a range of habitat types, none of which represents pre-settlement conditions, but many of which do provide a range of habitat values from absolute minimal to moderately complex.

Design of the Phase 2 fields and trails has been developed to avoid and minimize adverse impacts to the habitats on the site, especially wetlands. It is anticipated that there will be 6.0 acres of direct impacts to wetlands. It is proposed to compensate for those impacts by preserving wetlands, creating wetlands in areas where no wetlands currently exist, rehabilitating wetlands in areas of historic wetland, and enhancing some of the existing wetlands through various means as described below.

5.1 Overview of Proposed Phase 2 Compensation

Compensation actions will include enhancement of existing wetlands or portions there-of through changes in hydroperiods and/or increased species richness. Some existing wetlands are proposed to have a change in hydroperiod to increase the depth and/or duration of saturation/inundation within the wetland with the result of increasing plant richness and improving a suite of functions. Change in hydroperiods may be caused by changes to the outlets (e.g., berms, restricting outlets, backwatering, etc.) or change in wetland configuration through grading. Compensation actions will include creation of wetland in areas where no wetlands currently are present. Also, some wetland habitat will be re-established in the area of Mud Lake, the historic peat-based wetland that was present on the site after lowering of Lake Washington (1916), and before construction of the Naval Air Station (1930's) (see Figure 9).

Figure 10 illustrates where each type of compensation action is proposed in Phase 2. An overview of enhancement and creation actions is provided on Sheet L-4.04 of the large format drawings, with conceptual vegetation community plans shown on Sheets L-5.01, 5.02, and 5.03. Each type of compensation action is described in more detail in the sections of this report that follow. An individual wetland may have portions of it that are proposed to be enhanced, and portions that will be incorporated into larger created wetlands or systems; the two compensation actions (enhancement/creation) are described in separate sections below. Tables 5A and 5B provide a summary of the acreages of enhancement and creation, respectively.

Table 5A: Acreage of Enhancement

Wetland	Enhancement	
	Square foot	Acres
B1	21,744	0.5
B4	10,686	0.25
E1	50,560	1.16
E2	11,591	0.27
M1	14,336	0.33
M2	13,469	0.31
M5	14,744	0.34
M6	34,678	0.8
Total	174,753	**4.01**

Table 5B: Acreage of Creation

	Creation	
	Square foot	Acres
Polygon B	47,977	1.1
	43,064	0.99
Polygon E	9,191	0.21
	2,247	0.05
Polygon M	13,469	0.31
	294,576	6.76
	15,930	0.37
	11,129	0.26
Total	437,583	**10.05**

5.2 Wetland Enhancement

In Volume 2 of Ecology's Synthesis of the Science document (Ecology 2005), enhancement is defined as:

> *The manipulation of the physical, chemical, or biological characteristics of a wetland site to heighten, intensify, or improve specific function(s) or to change the growth-stage or composition of the vegetation present. Enhancement is undertaken for specified purposes such as water quality improvement, flood water retention, or wildlife habitat. Enhancement results in a change in some wetland functions and can lead to a decline in other wetland functions, but does not result in a gain in wetland acres.*

Enhancement is implied in the discussion as being often undertaken to enhance a single function or attribute (e.g., increasing native plant richness) often-times at the 'cost' of decreasing other functions (e.g., improving flood storage but degrading breeding amphibian habitat).

In Phase 2 several types of enhancement actions are proposed for a variety of wetlands (not all actions will occur in all wetlands):

- changes in hydroperiod,
- increases in native plant richness,
- increase in complexity of vegetation types and physical structure,
- increase in upland forest habitat within immediately adjacent buffer areas
- increased connectivity between wetland community types
- decrease in fragmentation of habitat caused by trails, human activities and dogs

Many of the wetlands to be enhanced will have a change in their hydroperiod generally through one of two means. Either the outlet configuration will be modified to impound water to deeper depths and for longer duration in the spring, or an area may be graded to lower the bottom contours and thereby result in a changed hydroperiod. Only the Promontory Ponds are dredged to expose groundwater; the other proposed grading actions in wetlands are generally driven by site topography and the need to create conditions where water will continue to flow passively through the site and eventually into Lake Washington. A more thorough description relative to each wetland area is provided below.

Excavation for either enhancement or creation purposes is generally proposed to be less than 3 feet in the zones of seasonal marshes. For habitats with expected longer hydroperiods (e.g., the northern tip of the Entrance Marshes) excavations will be 3-5 feet, and over 10 feet in the Promontory Point ponds. It is proposed to over-excavate zones of grading where planting is proposed, and mix into the sub-soil, by ripping, a minimum of 10-12 inches of peat. The City salvaged and stockpiled approximately 10,000 cubic yards of peat and organic soils from the Ravenna Creek day-lighting project starting in the late summer of 2005. The sole use of that peat was for use on this site to provide an appropriate source of organic material for the areas of enhanced or created wetland. Grades indicated on the grading plans and planting plans are all final grades, not the over-excavated grades.

Table 6 shows the acres of wetland enhancement that are proposed in Phase 2:

Table 6: Acres of Wetland Enhancement

Wetland	Enhancement	
	Square foot	Acres
B1	21,744	0.50
B4	10,686	0.25
E1	50,560	1.16
E2	11,591	0.27
M1	14,336	0.33
M2	13,469	0.31
M5	14,744	0.34
M6	34,678	0.80
Total	174,753	**4.01**

For enhancement or creation actions, it is proposed to use native species of trees, shrubs, and herbaceous plants. It is proposed to use certain shrubs and trees in early seral stage plantings, and re-plant or under-plant trees and shrubs when portions of the site have reached appropriate shade conditions. Under-planting will be done in locations where thickets of existing plants make under-planting appropriate. Species of plants proposed to be used for areas of enhancement are listed in Table 7, below.

Table 7. Plant species proposed for wetland creation and enhancement.

Stratum	Scientific Name	Common Name	Habitat Type[a]				
			Upland	PFO	PSS	PEM	PAB
Trees[b]							
	Abies grandis	Grand fir	X				
	Acer macrophyllum	Big leaf maple	X				
ES	*Alnus rubra*	Red alder	X				
	Crataegus douglasii	Black hawthorn		X			
ES	*Fraxinus latifolia*	Oregon ash		X			
	Malus fusca	Pacific crabapple		X	X		
ES	*Picea sitchensis*	Sitka spruce		X			
	Pinus contorta	Shore pine		X			
	Pinus monticola	Western white pine	X				
ES	*Populus balsamifera*	Black cottonwood		X			
LS	*Prunus emarginata*	Bitter cherry	X				
	Pseudotsuga menzisii	Douglas fir	X				
	Quercus garryana	Garry oak	X				

Stratum	Scientific Name	Common Name	Habitat Type[a]				
			Upland	PFO	PSS	PEM	PAB
	Rhamnus purshiana	Cascara	X				
	Salix lucida	Pacific willow		X	X		
	Taxus brevifolia	Pacific yew	X				
LS	*Thuja plicata*	Western red cedar		X			
	Tsuga heterophylla	Western hemlock	X				
Shrubs							
LS	*Acer circinata*	Vine maple	X				
	Cornus sericea	Red-osier dogwood		X			
	Corylus cornuta	Hazelnut	X				
	Holodiscus discolor	Oceanspray	X				
	Lonicera involucrata	Black twinberry		X			
	Mahonia repans	Tall Oregon grape	X				
	Physocarpus capitatus	Pacific ninebark		X	X		
	Ribes sanguineum	Red flowing currant	X				
	Rosa pisocarpa	Pea-fruited wild rose		X	X		
	Rubus parviflora	Thimbleberry	X				
	Rubus spectabilis	Salmonberry		X			
	Salix lucida	Pacific willow		X	X		
	Salix sitchensis	Sitka willow		X	X		
	Sambucus racemosa	Red elderberry	X				
	Symphoricarpus albus	Snowberry	X				
Emergent							
	Carex aquatilis	Water sedge				X	
	Carex obnupta	Slough sedge				X	
	Carex rostrata	Beaked sedge				X	
	Carex stipata	Sawbeak sedge				X	
	Eleocharis palustris	Common spikerush				X	
	Glyceria grandis	Reed mannagrass				X	
	Juncus acuminatus	Tapertip rush				X	
	Polygonum hydropiper	Water pepper					X
	Potamogeton natans	Pondweed					X
	Potentillia palustris	Marsh cinquefoil				X	
	Scirpus acutus	Hardstem bulrush				X	

Stratum	Scientific Name	Common Name	Habitat Type[a]				
			Upland	PFO	PSS	PEM	PAB
	Scirpus microcarpus	Small-fruited bulrush				X	
	Scirpus cyperinus	Woolly sedge				X	
	Sparganium eurycarpum	Giant burreed				X	
	Veronica americana	American brooklime				X	

[a] Habitat types as defined by Cowardin (1979) where: PFO = palustrine forested, PSS = palustrine scrub/shrub, and PEM = palustrine emergent; PAB = palustrine aquatic bed.

[b] Seral stages are denoted by: ES = early seral; LS = late seral; some species are not stage specific

Wetlands B1 and B4

Wetlands B1 and B4 are located in the southwest corner of the Phase 2 site, just northeast of the approximate intersection of 65th Street and Sportsfield Drive. They are both palustrine emergent wetlands dominated by native and non-native grasses. Wetland B1 is 1.63 acres in size and B4 is 0.27 acres. Approximately 1.13 acres of B1 will be eliminated by filling for Field 9, while only 0.02 acres of B4 will be eliminated for the toe of the fill for Field 6.

It is proposed to enhance 0.5 acres of B1 and 0.25 acres of B4. These two wetlands will be graded and included in a long wetland complex, the Entrance Marshes, flowing around the west and southern boundaries of Fields 6 and 9. The Entrance Marshes will be palustrine emergent marshes with shrub/sapling fringes on all margins. They will be depressional flow-through systems.

Currently there is a buried stormwater conveyance that carries runoff from the impervious surfaces in the Historic District of Magnuson Park (the Officers Housing located up the slope to the west of Sportsfield Drive) directly, untreated into Lake Washington. It is proposed to pre-treat the stormwater by installing Catchbasin Stormfilters® by Stormwater Management, Inc. with ZPG (zeolite, perlite, and activated carbon), a state-of-the-art treatment mechanism. The filter media is placed at the beginning of the treatment train, nearest the sources of automobile pollution. At the bottom of the hill, the stormwater conveyance pipe flow will daylight at the northwestern end of the Entrance Marshes. Portions of wetland B1 will be excavated to create the appropriate grades to allow water to move slowly down-gradient through created wetland marshes and through the former location of B4, until flows exit the Entrance Marshes through a leaky berm under the perimeter trail into the Marsh Ponds. The Entrance Marshes are described in more detail in Section 5.3, Creation.

Hydroperiod

Both wetlands B1 and B4 will have a shift in their hydroperiods to conditions that are more deeply inundated for a longer annual time period. In existing conditions, both wetlands receive surface water from a small surrounding catchment and precipitation; both areas pond shallowly (generally less than 6-12 inches), and both areas dry out by evapotranspiration once rainfall diminishes in late spring (little infiltration occurs in the existing soil profiles). There is a culvert that exists at the ‘outlet’ of B4 that empties into the buried stormwater line, heading east to the Lake.

The portions of the two wetlands identified as enhancement will be graded in general, 12”-24” inches deep for form emergent marsh habitat that will be inundated till late spring every year. Pre-treated water from the storm drain system will enter the wetland complex in the north-west end of the Entrance Marshes. Water will flow slowly down-gradient through a series of broad, unconstricted barriers which will create an approximate 10-inch drop in water level between each “pool” of the Entrance Marsh complex. Water will be impounded to approximately 3 feet in depth at the point the water enters the complex, but for the rest of the Entrance Marsh complex water will be generally less than 30 inches deep. It is assumed that infiltration rates will not increase over existing conditions, therefore water levels in the marshes are designed to dry out through evapotranspiration by early to mid-summer of each year. The unconstricted outlets and slightly deeper levels of inundation will result in fully vegetated marsh habitats, ideal for amphibian breeding, water quality improvement, and stormwater attenuation. The marshes may not hold water all summer, depending upon input from occasional summer rainfall events.

Vegetation

Wetlands B1 and B4, are dominated by native and non-native grasses in existing conditions, they are wet meadows. In conjunction with the proposed change in hydroperiod it is proposed to seed the marshes with a variety of native herbaceous emergent marsh plants to develop a palustrine emergent marsh habitat with a species composition suited to wetter conditions than existing. It is anticipated that a variety of sedges and rushes will be established in the long-term inundated conditions. See Table 7 for a list of proposed species for palustrine emergent habitats. The margins of the Entrance Marsh complex and up to the 12" capillary fringe zone along the edges of the marsh will be planted with a variety of native woody species including willows, red osier dogwood, and black cottonwood on the western and southern sides. It is expected that dense shrub communities will screen the marshes from the roads to the west and south, and from the field zone to the northeast. Black cottonwood trees will be limited from the wetland margins on the north and east sides to avoid the potential in the future of creating tall trees immediately adjacent to the toe of fill of the fields. The footprint of the fill for these fields has been reduced, in an effort to minimize and avoid additional wetland impacts, thus there is less margin on those edges for establishment of forest especially on the south margins of Field 9. It is assumed that the Entrance Marsh complex will be fully vegetated with no open water areas present in summer.

Wetlands E1 and E2

Wetlands E1 and E2 are located in the northern portion of Phase 2. Wetland E1 is centrally located and at 8.55 acres, is the largest wetland identified in the Delineation Report. Wetland E1 is a palustrine wetland with emergent, scrub/shrub, and forested communities. It is a Category III, depressional closed system. The emergent areas are a mixture of native and non-native grasses. Approximately 1.16 acres will be enhanced. Approximately 2.25 acres of E1 is proposed to be filled for athletic fields.

Wetland E2 is 0.7 acres and is located at the 'outlet' end of the swale that runs along the western side of the Sports Meadow. Wetland E2 is a palustrine shrub and emergent wetland. It is Category III, and a depressional flow-through (open) wetland. Approximately 0.26 acres of wetland E2 are proposed to be enhanced by increasing plant richness and structural complexity. Approximately 0.44 acres of E2 is proposed to be filled for a rugby field and to make an ADA accessible trail link.

Hydroperiod

The majority of wetland E1 will be left intact in Phase 2. Approximately 1.16 acres of E1 are proposed to be enhanced by changes in the hydroperiod and increasing plant richness, diversity and structural complexity. It is proposed to change the hydroperiod in the portion of the wetland that lies between Field 5 (the rugby field) and sub-grade (fill) for the proposed future soccer field to the south. This area, the Grove Marsh, will become wetter than existing conditions by the placement of a very shallow berm projecting to the northeast from the northeast corner of the sub-fill for the proposed soccer field. Water collected in the under-drain system on Field 1 will be discharged at the southeast corner of the field, at the west end of the Grove Marsh. This stormwater, plus precipitation and sheet flow from the catchment area to the north, will collect in the Grove Marsh. Water will be discharged through a leaky berm to the south into the remaining portion of unaltered wetland E1. Stormwater flows from largest storm events will overtop the berm. The berm, at a maximum height of approximately 16 inches, is designed to cause backwatering into the Grove Marsh area.

This passive increase in depth of inundation and area of inundation/saturation in E1 is proposed to allow the establishment of emergent and woody vegetation that is adapted to deeper and longer inundation, rather than the wet pasture grasses that currently predominate the area.

Wetland E2 will be altered in a more complex manner than wetland E1. As noted, waters flow into E1 from the north and disperse as sheet flow to the south, southeast at the southern terminus of the wetland. Field 5 is proposed to intercept and fill the mid-section of this wetland, which would have effectively cut-off water from the north into the south portions. In order to not dewater the southern portions of the wetland it is proposed to shift the swale feature to the east, so that it runs parallel to the eastern margin of the field footprint. No additional water will be directed into E2 than what currently flows there, thus the hydroperiod is expected to remain consistent: filling with the winter rains, and emptying in spring as rains cease and evapotranspiration kicks in.

Vegetation

In the portions of wetland E1proposed for enhancement it is predominantly wet pasture dominated by native and non-native grasses and forbs. There are also currently scattered thickets of non-native Himalayan blackberry and hawthorne, as well as a stand of native Sitka willow, birch, and black cottonwood. No grading is proposed within the 1.16 acres of E1 where enhancement will occur. Thus the stand of trees/saplings will remain, although the hydroperiod will change with approximately 12 inches more inundation till later in the spring. Plugs of native emergent species are proposed to be installed in the emergent zone of the enhanced E1. Species such as wooly-headed rush, manna grass and slough sedge will be installed. Because no grading will occur, it is expected that tolerant species remaining will recover (e.g., smooth rush, small-fruited bulrush). It is not anticipated that cattails will become a dominant in these marshes as the soils will not be disturbed and the annual drying regime may preclude them.

Wetland E2 is a palustrine shrub and emergent wetland. It contains a range of shrub and saplings along the swale, including black cottonwood and Sitka willow, and it has a variety of the typical native and non-native grasses and forbs that are common on this site. It is proposed to plant the entire area that is identified as enhanced with a variety of native shrubs and sapling trees. In portions which are already covered with shrubs/saplings, red cedar will be under-planted. In areas newly graded, hydroseeding will be overtopped with wetland shrubs such as Sitka willow, red osier dogwood, nine-bark, black twinberry. Tree saplings will include black cottonwood, Oregon ash, Sitka spruce. This community will be a shrub sapling for the first 5-10 years, until the black cottonwood begin to obtain sufficient height to begin to offer some 'tree' effect (e.g., perches, nesting sites, roosts).

Polygon M: Wetlands M1, M2, M5, M6 and Ditch 4B

These wetlands in the southeast portion of Phase 2, are all Category III wetlands. They have a variety of Cowardin classification types. Wetland M1 is a palustrine forested and emergent wetland; M2 has both emergent and shrub communities; M5 has emergent and shrub communities; and M6 is the most complex of these wetlands with forested, shrub/sapling and emergent vegetation communities present. All of the "M" wetlands are considered depressional closed for their hydrogeomorphic classification; the wetland associated with Ditch 4B is a flow through system. Ditch 4B is included within this discussion as it is directly tied to actions in wetland M6.

The enhancement actions for these wetlands vary considerably, therefore they will be described separately.

Wetland M1

Wetland M1 is located northeast of Field 6, inside the perimeter trail, immediately north of the northern overlook. It is 0.33 acres and all of it is proposed to be enhanced. In existing conditions, this wetland contains stands of native trees interspersed with wet grassland dominated by a mixture of native and non-native species. No grading work is proposed in the wetland and no significant change in hydroperiod is expected. Enhancement actions will include removal and control of invasives such as Himalayan blackberry and Scott's broom, then installation of additional saplings and shrubs.

Hydroperiod

Sheet flow from the surrounding catchment and precipitation are the sources of water for M1. Due to the compacted nature of the soils, no groundwater linkage exists and it is assumed that little, if any infiltration occurs. It is not proposed to change the hydroperiod of the wetland, enhancement actions focus on vegetation and expanding the wetland area passively (see Polygon M creation discussion below).

Vegetation

Wetland M1 has existing stands of black cottonwood, Sitka willow and common hawthorn, well interspersed with thickets of Himalayan blackberry. Wet meadow area contains colonial bent-grass, redtop, and soft rush. It is proposed to physically remove the blackberry and its roots, then sheet mulch and apply woodchip mulch to control re-establishment. It is proposed to add red cedar and/or Sitka spruce in appropriate locations within the wetland, live-stake black cottonwood in groves in the grassed areas and where blackberry thickets were present, as well as a diverse shrub component including ninebark, twin berry and pea-fruited rose. Wood debris and brush piles will be added to increase physical structure and complexity for wildlife use.

Wetland M2

M2 is a Category III wetland with a depressional closed hydrogeomorphic class. It is a palustrine emergent wetland dominated by native and non-native grasses with scattered hawthorne shrubs. It is 0.43 acres, of which 0.12 will be filled for an trail system overlook; the remaining 0.31 acres will be converted to different hydroperiod and vegetation community types to increase functions for water quality and wildlife habitat (prey production).

Hydroperiod

It is proposed to convert the seasonally inundated grasslands of M2 into shallow marshes and shrub habitats which will provide a greater range of wildlife habitat, specifically for prey production. These habitats are being called the Marsh Ponds. The ponds are designed to fill with water every fall from precipitation and from sheet-flow entering them from the north and west. The Marsh Ponds will be 12-18 inches deep with broad unconstricted outlets. This will allow them to fill up and remain full throughout the winter and into late spring, with little or no water level fluctuation from to storm events. These conditions, along with the proposed thin-stemmed emergent vegetation communities, will provide excellent breeding habitat for native amphibians (e.g., Pacific chorus frogs) and multitudes of insects as prey species. The water regime is expected to be prolonged over existing conditions due to the deeper inundation than the existing grasslands.

Vegetation

One of the primary goals of the Marsh Ponds is provide good amphibian and invertebrate breeding habitat. To that end, it is proposed to seed in a variety of native emergent marsh species with thin stems (preferred for some amphibians for egg masses) and invertebrate predators (e.g., dragon flies). Emergent plant species proposed to be used in many of the emergent habitats to be seeded include those listed on Table 7.

The zones between the shallow emergent marshes will be berms with shrubs installed as live stakes, fascines, and/or whole logs (e.g., black cottonwood salvaged from on-site). The shrub zones are intended to be planted with a variety of wetland species as shown on Table 7.

It is not proposed to plant trees in the zones between the Marsh Ponds, although it is expected that trees will establish over time. Except for minor use of live black cottonwood for outlet weirs, trees are not being installed as they would shade the marshes, reducing the benefit for amphibians and invertebrates. Black cottonwoods and perhaps alders will seed in naturally over time (no enhancement "credit" is taken for trees in this zone).

Wetland M5

Wetland M5 is located west of the existing road that heads north to the interior (tennis court) parking lot, just northeast of the turn-off to the boat launch. It is a 1.39-acre Category III wetland with palustrine shrub and emergent habitats. It is a closed depression based on the hydrogeomorphic classification. Only 0.06 acres (4.3%) of the wetland will be impacted as the result of the grading necessary to make the movement of water through other wetlands and into the outlet pipe. The impact will be caused by grading which will eliminate hydroperiod at the far south end of the wetland, and grading to create a small berm with a trail between the two proposed wetland outlets. There will also be a small impact area at the south end of the existing undisturbed portion of wetland M5 where a small berm will be constructed to help prevent dewatering of the upper reach of the existing wetland. Of the existing wetland, 0.34 acres will be enhanced through grading to prolong hydroperiod and supplemental plantings. In existing conditions, this wetland contains stands of native trees interspersed with wet grassland dominated by a mixture of native and non-native species. In addition, 0.37 acres of new wetland will be created adjacent to M5; this is discussed in the Creation section, below. Enhancement actions within M5 will also include removal and control of invasives such as Himalayan blackberry, and installation of saplings and shrubs adapted to wetter conditions.

Hydroperiod

Portions of the southern limits of wetland M5 will be graded to create the necessary outlet elevations necessary for the Promontory Point pond complex and the Link Marsh Complex. The outlets of both of these Complexes will drain into outlet structures that will discharge directly into the existing buried 30-inch storm drain that empties into Lake Washington in existing conditions.

Both Complexes are designed to drain into the buried storm-drain for one primary reason: extensive grading of the existing Park between the current Phase 2 limits and the shoreline of the Lake would be required to establish the necessary grades to create a surface outlet connection to the Lake. It was determined that using the already existing storm-drain would create a significant cost savings for Phase 2, allow greater design and implementation efforts within Phase 2 rather than spending dollars on a surface outlet, and would continue to utilize the same outlet path that much of the on-site water currently travels, thus maintaining the status quo.

Lastly, there is an existing U.S.G.S. survey monument located in this area which is used as a regional calibration facility for technical survey equipment. It was strongly requested by U.S.G.S. that this stationing point not be disturbed or eliminated if possible, through the course of the site design.

In existing conditions, waters from M5 drain towards the south where they exit under the Beach Drive road through a culvert system, into a series of ditches into the Lake. The existing hydroperiod of the wetland is sheet flow and shallow standing water in the winter, likely not more than 6-12inches in dept. It is not anticipated that the excavation at the 'bottom' (southern) end of the wetland will act to dewater the upper remaining portion of the wetland because existing grades are so flat, there is no slope to create a hydraulic head that will cause water to drain faster into the excavated portion. Furthermore, the berm being constructed across the south end of the existing undisturbed portion of wetland M5 will also minimize dewatering. Water flowing north to south through the wetland will be forced to back up to a depth of approximately 6 inches before overtopping the berm.

For the Promontory Pond Complex, it is proposed that a new outlet will be created by excavating approximately 4 feet below existing grade, and then placing a storm-drain overflow riser at elevation 22.5 to exit into the buried storm-drain. This will create long-term seasonal ponding of water of approximately18 inches in the lowest portion of the Promontory Point Complex creating deeper zones of inundation for longer duration than existing conditions.

For the Link Marsh Complex the outlet will be placed at the north end of the series of wetlands, connecting M6 (existing conditions) to the outlet location of M5 (existing conditions). As described for the Promontory Pond Complex, above, the outlet for Link Marsh Complex will direct flows to a storm drain overflow riser at an elevation of 21.0 that will convey water to the buried storm drain. In existing conditions, M5 drains out under Beach Drive through a culvert. That culvert will be blocked and flows will leave the wetland via the overflow riser to the storm-drain. Water is expected to pond 1-2 feet in depth in this portion of the wetland creating a zone of deeper inundation and longer duration for vegetation adapted to those conditions.

Vegetation

For both the marshes at the outlet of the Promontory Point Ponds and the Link Marshes, it is expected that they will become emergent marshes with fringes of shrub and sapling/forest communities. Emergent marsh will include a variety of the species listed on Table 7. It is intended to seed those species which are particularly successful at establishment through seeding. The portions of M5 that are proposed to be enhanced are predominantly wet grasslands in existing conditions. Grading to create the necessary contours will result in unvegetated soils where seeding will have a greater likelihood of success.

There are also some scattered black cottonwood sapling groves and some thickets of Himalayan blackberry. In conjunction with the creation efforts (described below) it is expected that the diversity of plant community types, the diversity of hydroperiods created, and the increase in structural complexity will result in improved function for habitat and water quality. Shrub communities and sapling trees will be installed around the perimeters of the two wetland areas, and upland forests will be established on the upland zones between the wetlands. Species to be installed will include those listed in Table 7.

In areas where shrub or sapling thickets are present it is proposed to under-plant with late seral stage conifers such as red cedar and grand fir. Where grading will create plantings zones of bright light, it is proposed to begin plantings with early seral stage trees such as red alder, black cottonwood, Douglas fir, Western hemlock as the main 'canopy' components. As the deciduous trees mature (i.e., after year 3-5 depending upon growth patterns), later seral stages species will be under-planted under the closed canopy of the early stage plantings. Second or later seral stage conifers include red cedar, grand fir, and shrubs such as tall Oregon grape, vine maple etc.

<u>Wetland M6 and Ditch 4B</u>

Wetland M6 and Ditch 4B are located in the southeast corner of Phase 2, where 65th Street turns north and becomes Beach Drive, just west/south-west of the boat launch parking area. Wetland M6 is 0.96 acres and contains forested, shrub, and emergent wetland communities. It is a Category III wetland and is considered a depressional closed hydrogeomorphic class. Approximately 0.16 acres are proposed to be impacted by grading to assure that grades and subsequent water flow will work in Phase 2. Roughly 0.8 acres of M6 will be enhanced by a change in hydroperiod, an elimination of non-native species, and an increase in species richness by installation of additional native species.

Ditch 4B is 0.08 acres of an old roadside ditch that still collects untreated runoff and channels it through dense vegetation prior to it discharging to Lake Washington. It is anticipated that 0.01 acres of Ditch 4B will be eliminated because of grading activities. It is proposed that 0.07 acres of the ditch will be enhanced through slight grading and changes in the hydroperiod by linking it to wetland M6 to create a larger more complex system.

Wetland M6 currently collects water from the surrounding catchment, including runoff from the large soil stockpile area immediately to the west. It functions basically as a closed depression, until waters collect sufficiently to sheet-flow eastward into Ditch 4B, where they exit through a culvert under the road to the interior parking lot. Flows from the culvert coalesce with other flows from ditches and culvers, and combine to flow through an open ditch into Lake Washington immediately north of the boat launch.

In existing conditions, there is an old catch basin system along portions of 65th .The catch basins are only marginally effective, and the stormwater that is collected is conveyed to Lake Washington untreated. The stormwater that is not collected in the catch basins sheet flows off the road shoulder into roadside ditches or wetlands. It is proposed in Phase 2 that the northern shoulder of 65th will be improved, and surface water from the road surface will flow across a filter strip or ecology embankment to a newly created vegetated swale paralleling 65th, just west of a newly created portion of M6. The bioswale is designed to provide pre-treatment to the stormwater prior to entering the wetland complex. This will provide two levels of improvement: stormwater from 65th which currently flows untreated into Lake Washington will be collected, pre-treated and then run through hundreds of linear feet of vegetated wetland prior to being discharged to the Lake. Secondly, the capturing the sheet-flow from 65 will provide an increased volume of water through this wetland complex, thereby increasing the duration and depths of inundation favoring more wetland tolerant vegetation.

In the existing southern-most portion of wetland M6 grading will enhance the hydroperiod by increasing the depth and prolonging the duration of inundation. Water will pond to a depth of approximately 24 inches, then flow east to enter Ditch 4B. Wetland M6 will be graded to be integrated with Ditch 4B to create a larger more complex wetland system. Ditch 4B will be widened to create more wetland habitat, and re-configured to meet and incorporate the grassed portions of M6 as the flows head north, parallel to the parking lot access road. It is proposed that three larger ‘pools' of emergent marsh will be created, and linked with a narrower vegetated channel, the whole named the Link Marsh Complex. Ditch 4B and the waters it conveys become integrated with wetland M6; together they convey the flows from the west, and flows that entered the ditch from the south of 65th. All the waters collect in the north end of the Link Marsh Complex and discharge via a storm drain overflow riser at elevation 21.0. From the overflow riser, stormwater is conveyed to the buried storm drain which drains directly to Lake Washington.
As the primary source of the water for this system is rainfall and sheet flow, it is expected that they will be full all winter and dry out each summer, reflective of our natural hydrologic cycle.

Vegetation

As noted above, it is proposed to grade wetland M6 and Ditch 4B to create grades that collect and move water through the Link Marsh complex and off the Phase 2 site. The grading is designed to avoid, where at all possible, the existing stands of black cottonwood saplings and young trees present within wetland M6. It is also designed to not dewater the untouched portions of M6, but allow a slight increase in hydroperiod to the zone of black cottonwoods; assuming they'll be tolerant of increased saturation while Himalayan blackberry intrusion will be further limited. Stands of existing black cottonwood will be under-planted with red cedar and Sitka spruce to provide later seral stage plant richness and increase structural complexity. In existing conditions, the portions of M6 that are not thickets or groves of young black cottonwood are wet grasslands dominated by native and non-native grasses. These grassed areas would be planted with early seral stage trees and shrubs to begin to form a closed canopy condition. The portions of M6 that are graded to form deeper marsh habitat will be seeded with species identified on Table 7 for emergent habitats. This entire area will also be surrounded along the roads and path margins with moist to upland forests to provide increase habitat complexity and structural diversity.

5.3 Wetland Creation

In Volume 2 of Ecology's Synthesis of the Science document (Ecology 2005), "creation" is defined as:

> *The manipulation of the physical, chemical, or biological characteristics present to develop a wetland on an upland or deepwater site where a wetland did not previously exist. Establishment results in a gain in wetland acres. Activities typically involve excavation of upland soils to elevations that will produce a wetland hydroperiod, create hydric soils, and support the growth of hydrophytic plant species.*

In Phase 2 there are several actions proposed to create wetlands on the site where none currently exist or to re-establish wetland where they were previously:

- Dredging to create elevations that create wetland hydroperiod;
- Dredging to remove fill and expose groundwater and peat soils to re-establish wetland in the location of historic wetland area (but not to attempt to re-create those wetland communities);
- Back-watering of upland areas (with no dredging) to create wetland hydroperiods;
- Modifying the grade of a site and directing surface flows to create long-term inundation;
- Creating areas of inundation for sufficient duration that capillary fringe action will create wetland conditions in soils that are not inundated.

In general, the wetlands that are to be created will be associated with previously existing wetlands (Table 8). Either the new wetland areas will be expansions of the former wetlands, or they will hydrologically link existing wetlands through an enlarged system, and/or they will be created to assure that hydroperiod of wetlands to remain are not adversely affected. It is proposed to create wetlands by deep dredging (Promontory Ponds), by shallow grading (the lower portions of the Entrance Marsh and the Link complex); or by creating a capillary fringe zone (the area between the Promontory Point ponds).

Creation actions are described in Sections below related to the Polygons that the actions occur within (see Sheet L-4.00). In this manner the creation of new wetland area that links existing wetlands into complexes is more logically presented. The following acres of created wetlands are proposed:

Table 8: Acres of Wetland Creation by Polygon

	Creation	
	Square foot	**Acres**
Poly B	47,977	1.1
	43,064	0.99
Poly E	9,191	0.21
	2,247	0.05
Poly M	13,469	0.31
	294,576	6.76
	15,930	0.37
	11,129	0.26
Total	437,583	**10.05**

As noted for the Enhancement discussion, above, excavation for creation purposes is generally proposed to be less than 3 feet in depth. The exception will be fore the Promontory Point ponds where excavation to re-establish wetlands in that area will be over 15 feet deep to expose groundwater and create deep-water habitats. In areas where planting is proposed in graded soil, the substrates will be over-excavated and ripped with a minimum of 10-12 inches of stockpiled peat. The grades indicated on the project grading plans and planting plans are all final grades, not the over-excavated grades.

Only native species of trees, shrubs, and herbaceous plants will be used in the habitat creation areas. Early seral stage plantings of trees and shrubs will be eventually under-planted with later seral stage trees and shrubs when those portions of the site have reached appropriate shade conditions. Species of plants proposed to be used for areas of habitat creation are listed in Table 7, above.

Polygon B

Polygon B is the area in the southwest corner of Phase 2, northwest of the intersection of 65th Street and Sportsfield Drive, see Sheet L-4.00. Polygon B contains 4 wetlands in existing conditions, and it is the site of the proposed Entrance Marsh complex. In Polygon B, wetlands B2 (0.33 acres) and B3 (0.48 acres), is proposed to be totally eliminated for creation of Field 6. Wetlands B1, B2 and B4 will have 1.13, 0.33, and 0.02 acres of fill, respectively.

It is proposed to link B1 and B4 into the Entrance Marsh. It is a long wetland complex formed by enhancing 0.5 acres of B1 and 0.25 acres of B2 (described above), and creating an additional 2.09 acres of new wetland where none currently is present. Through grading, the appropriate topographic conditions will be created to form areas of long-term inundation (from 30” to 18” in depth) until late spring of each year. These newly created emergent marshes will be fringed with wetland shrub/saplings and eventually wetland and upland forest habitats. The created wetland area will merge with the enhanced portions of B1 and B4 to form a long complex with flow-through hydroperiods. Sheet L-5.02 shows the proposed plant communities, and Sheet C3.02 shows the proposed grading for the Entrance Marsh complex. The eastern-most portion of the Entrance Marsh complex shows up on Sheets L-5.03 and C3.03.

Hydroperiod

Water movement in Polygon B will be from west to east, through the created Entrance Pond complex. The water in the Entrance Ponds will come from precipitation, surface runoff from the immediate catchment area, and subsurface drainage from Field 9. However, the greatest contribution of flows to this wetland complex will come from an existing stormwater pipe along the north edge of Field 9 that conveys untreated stormwater runoff from a large upstream basin to Lake Washington in existing conditions. Just upstream of the Phase 2 project area, the storm drain line will be diverted and day-lighted into the far northwest chamber of the Entrance Marsh complex. Water moving east through the marsh complex will exit under a pedestrian path through a leaky berm, into the Marsh Ponds of Polygon M.

Water quality pre-treatment of the runoff from the upstream basin will be accomplished by source control of automobile pollution. In the upstream basin, catch basins that collect runoff from vehicular-accessed paved surfaces will be replaced with Catchbasin Stormfilters® by Stormwater Management, Inc. The proposed ZPG (zeolite, perlite, and activated carbon) filter media provides water quality treatment meeting the requirements of the Washington Department of Ecology. Runoff from one catch-basin cannot be captured and pre-treated prior to the flows entering the system.

Because the primary source of the water for the wetland will be stormwater and precipitation driven, it is assumed that the wetland will have a typical hydroperiod of becoming wet every fall, remaining full all winter, and slowly loosing surface water into spring and be dry by early summer of each year. Depths are designed to allow long-term inundation of up to 30 inches (generally), with broad unconstricted weir-like outlets. Water levels will become stable from early winter rains (in normal precipitation years), and most typical storm events will result in only minimal water surface fluctuation. This will result in a hydroperiod pattern that is preferred by native amphibians and invertebrates that provide food sources to birds, bats, and other predators.

The wetland complex is designed to have approximately 10 inch drops in water surface elevation through a series of broad weirs that are intended to function like beaver dams: they will have broad unconstricted outlets to preclude water level fluctuations associated with rainfall events. The weirs may be constructed out of rocks, logs (e.g., black cottonwood LWD), fascines, or combinations there-of. It is important that the weirs function like beaver dams in that they have multiple locations for water to seep/flow through and that flows are not constricted resulting in water level fluctuations.

It is expected that the long-term inundation in the shallow pools will result in a capillary fringe of saturated soils with sufficient duration to promote the growth of woody wetland shrubs and sapling-stage trees. Just as noted for the enhancement zones, the excavated/created areas of new wetland will be over-excavated and ripped with organic soils to augment the existing mineral-based soils that are on the site.

Water from the Entrance Pond complex will exit the complex through a leaky berm under the primary north/south pedestrian path (see Sheet L-5.03). The purpose of the leaky berm (see illustrative detail for the berm on Sheet C 5.02) is to allow water to exit the wetland over a broad area, thus minimizing the opportunity for water level fluctuations in response to small rain events. Water will be dispersed across a broad area at a very slow rate, allowing water to gently move into the Marsh Ponds, located to the east.

Vegetation

As noted in the discussions above related to emergent marsh enhancement areas, a similar palette of native emergent species would be proposed within these created wetland areas. Thin-stemmed vegetation is preferred for amphibian egg masses and nest-building for small marsh birds such as marsh wrens.
The margins of the Entrance Marsh complex will be planted with native woody shrubs and sapling-stage trees. This will form a thicket of shrubs and sapling trees around the marsh margins to protect them from

physical intrusion (humans and dogs), create additional physical complexity, provide shade to the margins of the marsh, and over-time, create forest habitat for the non-aquatic stages of the life-history needs of the aquatic-breeding species using the marsh. Between the trails and the wetland margin non-friendly native thorny shrubs (e.g., gooseberry, salmonberry, hawthorne, etc.) will be placed to discourage ready access to the wetland margins, except in designated locations. The margins of the fill for the two fields will not be planted with trees such as black cottonwood, to protect the integrity of the fill slopes over time.

For the west and south slopes, dry upland forests will be installed as described in Section 5.5, below. Dry, sunny forests will include canopy species such as Ponderosa pine and Garry oak. Mesic/moist forests will be installed on north/east facing slopes and within all the flatter gradient upland forests. Dominant species within these forests will be Douglas fir and western hemlock.

<u>Polygon E</u>

Polygon E is the north portion of Phase 2, east of Sportsfield Drive and south of the Junior League playground, see Sheet L-4.00. Polygon E contains 3 wetlands in existing conditions, and it is the site of the proposed Grove Marsh. Wetland E1 (8.55 acres) is proposed to have 2.25 acres of fill for Field 5 and a sub-grade field fill. Wetland E2 (0.70 acres) is proposed to have 0.44 acres of impacts for the eastern end of Field 5, and have 0.27 acres of enhancement and 0.05 acres of newly created wetland. Wetland E3 is not in the Phase 2 project area.

In a portion of the large E1 wetland it is proposed to backwater an area of existing wet grassland, install woody shrubs and saplings in another zone where no hydroperiod change is proposed, and to create an additional .05 acres of new wetland where none currently is present. The newly created emergent and shrub/sapling marsh habitat will be created west of the existing wetland edge, north of the proposed sub-grade field fill. Sheet L-5.01 shows the proposed plant communities, and Sheet C 3.01 shows the proposed grading for the Grove Marsh.

Hydroperiod

Water movement in the E Polygon portion of Phase 2 will be generally from north to south. Surface flows will move through enhanced portions of E1 and E2 wetlands to enter untouched portions of E1, and from there sheet flow into Polygon M to the south. Water sources within the Grove Marsh include precipitation, small contributions from the surrounding unaltered catchment, runoff from a portion of the existing grass playfield to the west of Field 1 (piped under the field to the Grove Marsh), and field runoff. Field 1 will have an under-drain system that will collect precipitation and irrigation run-off, and direct the collected flows to the east, at the west edge of existing wetland E1. There will also be a shallow swale created along the eastern margin of Field 1 that will collect surface runoff from the north, and direct it to the south, into the created portion of the Grove Marsh. Irrigation water, although applied in the spring/summer seasons, are not expected to created long-term inundation or saturation within the Grove Marsh. If appropriately applied, irrigation to natural grassed fields should not be applied to such a volume that run-off from beneath the field will occur. Best Management Practices for the natural grassed fields should result in little, if any, summer runoff from these fields which would be an expensive waste of irrigation water.

To the northeast of the NE corner of the proposed sub-grade field, it is proposed to create a shallow berm paralleling the northern boundary of the subgrade fill. This berm is intended to cause water flowing into the created and enhanced portions of the Grove Marsh to back up to a maximum depth of approximately 16 inches. The impounded stormwater will be discharged through a leaky berm to the south into the remaining portion of unaltered wetland E1. Stormwater flows from largest storm events will overtop the berm. The construction of the berm will cause a change in hydroperiod in this portion of existing wetland E-1, causing a deeper zone of inundation with longer duration than existing conditions, and increased saturation/duration for the upper zones of E-1 in this area (see Sheet L-5.01).

Field 5 is designed so that surface water will be collected in an under-drain system, and discharged on the southern limits of the field, mid-section (see Sheet L-5.01 or the grading Sheet 3.01). A slight amount of grading is proposed within wetland E1 at this location to match the designed grades of the field. The grading will allow water to be discharged in a broad shallow flat swale into the remaining portions of wetland E1; resulting in an increase in the depth and duration of saturation/inundation in this portion of wetland E1. Flows from this area will be allowed to sheet flow into the rest of wetland E1 with no additional grading proposed in that wetland in Phase 2.

Wetland E2, as described above in the Enhancement section, collects runoff from the surrounding catchment area, and may have historically collected some very minor runoff from the former Sports Meadow to the east. In existing conditions, wetland E2 is a vegetated swale that ends as unconfined sheet flow at its southern limit. The proposed Field 5 will impact the ‘mid-section’ of E2. It is proposed to create a new vegetated swale along the eastern limits of the fill for Field 5, to allow water from the north to continue to flow to the south, and sheet flow into the interior of the habitat area. No field discharge is proposed into this relocated swale, and new trails to the north will make provisions (e.g., culverts) for flows from the north to continue to flow to the south. No change in volume, rate, duration or inundation/saturation is expected in the remaining portions of E2.

Vegetation

The proposed changes in the hydroperiod and associated change in plant communities in E1 are described in the Enhancement Section, above. Where flows from Field 1 will create new wetland, west of E1, it is proposed to plant this area with both emergent and shrub/sapling communities (see Sheet L-5.01). The increase of hydroperiod is intended to create the appropriate seasonal hydroperiod for obligate native emergents (plants will be installed by plugs) and native wet tolerant shrubs and sapling trees. The existing stand of black cottonwood in this area of E1 will remain, and it is expected that vitality may be affected by changes in the hydroperiod. The designed shift in hydroperiod of greater inundation and longer duration will also occur north of the emergent zone. This wetter zone won’t create the long-term inundation necessary to maintain diverse native emergents but will create appropriate habitat for wet tolerant native woody shrubs and saplings as noted on Table 7, above. Surrounding the Grove Marsh it is proposed to enhance the moist upland forest habitat, as described in Section 5.4, below.

Polygon M

Polygon M is the entire south central portion of Phase 2, east of the proposed main north/south pedestrian trail, north of 65th (see Sheet L-4.00). Polygon M contains 7 wetlands in existing conditions, of which 3 (M3, M4, and M7) are not located within the Phase 2 boundaries, and therefore there are no proposed changes to them. Polygon M is the area with the greatest acreage of proposed creation of new wetland in the entire Phase 2 project area. It is proposed to create 7.69 acres of new or re-established wetland in this Polygon. In addition, it is proposed to enhance 1.84 acres of existing wetland including 0.07 acres of Ditch 4B, located on the eastern edge of the Polygon. The enhancement actions are described in the Section above and the creation efforts are described following.

Creation actions in this polygon will be achieved by lightly grading to create appropriate grades for shallow inundation for longer durations; by grading to re-establish permanent open water wetland habitats in the location of former wetlands (but not to recreate the same habitat types); and by creating saturation within 12 inches of the surface to promote the establishment of woody shrubs and saplings. Sheet L-5.03 shows the proposed plant communities, and Sheet C-3.03 shows the proposed grading for the Marsh Ponds, the Link wetlands, and the Promontory Point ponds.

Hydroperiod

Water movement through this area will generally be from west to east, and from north to south/southeast. Water enters from Polygon B to the west through a leaky berm under the pedestrian path; and from Polygon E from the north as sheet-flow and flow over a broad-crested weir constructed at the south end of the North Marsh Pond. All waters that enter this Polygon exit through two storm drainage outlet structures located in the northeast terminus of the Promontory Point ponds and the Link ponds. Water will be discharged into an existing buried 30inch storm drain that empties directly into Lake Washington. No grading or other work will be conducted for Phase 2 east of Beach Drive, nor below the OHWM of Lake Washington or the surface ditch that drains to the Lake, north of the boat launch.

Marsh Ponds

Water will enter the North Marsh Pond as precipitation, inflow from the surrounding catchment, and as shallow surface flows through a leaky berm under the pedestrian path along its northwest margin. (See Sheet L-0.01). Existing wetland M1 will be enlarged passively by creating a shallow berm south of it at the northeast corner of the constructed upland overlook that forms the new North Marsh Pond southern boundary. The mass of the overlook and the small berm will shallowly impound water to create 0.31 acres of new wetland area. No grading is proposed within wetland M1. The new wetland area will be seasonally inundated to approximately 6 inches in depth at the deepest points. The impoundment at this location may also serve to cause slightly longer duration of inundation and soil saturation in the existing M1 as it drains to the south as sheet flow in existing conditions. Water levels are expected to not fluctuate, as there will be a broad unconstricted outlet; hydroperiod will be seasonally inundated and dry out every summer. See the proposed grading on Sheets C3.02 and C3.03, and proposed plantings on Sheet L-5.03.

Water will exit the North Marsh Pond over the broad berm and enter the East Marsh Ponds. These small cells of wetland are designed to be emergent marsh surrounded by shrub/sapling wetland communities. Water will enter the marshes across unconstricted outlets, fill each cell with the fall/winter rains, and stay full and stable until late spring/early summer dries them out again. These marshy ponds are designed to be shallow (12-18 inches) wetlands filled with thin-stemmed vegetation. Water will passively flow from one to the next so they will be depressional flow-through systems in essence with a seasonal hydroperiod. The existing M2 wetland will be converted to an emergent/shrub complex with longer duration of inundation than it currently has. As in all these Marsh Ponds, the emergent zones will be surrounded by shrub/saplings. Precipitation will of course be an additional source of water, however it is assumed that surface flows will be the dominant source of water. The West Marsh Ponds will receive their primary source of water as slow moving flows entering from Polygon B (Entrance Marsh) to the west. Water will leave the Entrance Ponds wetland complex through a leaky berm under the pedestrian path. It will then act like the water in the East Marsh Ponds: collecting seasonally in shallow vegetated pools, flowing through the sequence of marshy pools, through another leaky berm under another pedestrian path, and from there into the marsh edges of the Promontory Ponds.

Promontory Point Ponds

The Promontory Point Ponds are the only wetlands in Phase 2 proposed to have permanent open water habitat with a water level that is assumed to remain stable all year-round. The Promontory Point Ponds will be excavated to a depth of up to 15 feet, (up to 11 feet of standing water; refer to grading plans), in the vicinity of the historic Mud Lake. The deep excavation will expose the groundwater in this area which is loosely correlated to lake water levels. In addition to ground water, the Prom Pt Ponds will receive surface sheet flow from the entire Marsh Pond complex to the northwest as well as runoff from the remaining portion of the parking west of the Commissary Building. However the most significant input of water for the Prom Pt Ponds will be a constant flow of approximately 400 gallons per minute of water that is currently being discharged to Lake Washington through a pipe from the U.S.G.S. fish research station located to the south of 65th Street. The location of the U.S.G.S discharge pipe has been identified, and the elevations will work to allow this water to be directly discharged into the Prom Pt wetlands, creating a consistent source of water that will allow consistent year-round water levels in the ponds. In existing conditions, the U.S.G.S water is withdrawn from Lake Washington, used in the fish research facility, treated (chlorinated and then de-chlorinated), and then returned to the Lake, all with appropriate water use and water quality permits. We are proposing to simply 'intercept' that cycle and introduce the water to the wetland complex prior to discharging it at the outlet of the wetland complex back into a buried storm-drain to discharge to Lake Washington.

The grading will form a variety of water depths below the surface around the perimeter of the ponds to allow a range of plant species to flourish. Water from the south Prom Pt Pond flows through two shallow marsh surface connections into the North Prom Pt Pond. Water leaves the Prom Pt Ponds in the northeast corner of the North Prom Pt Pond through a storm drain overflow riser that connects directly with an existing buried 30 inch storm drain. The storm drain discharges directly to Lake Washington, north of the boat launch to the east of the Prom Pt Ponds.

Link Ponds

The Link Ponds are located in the southeast corner of Phase 2, in the northwest quadrant of the intersection of 65th Street and Beach Drive. They are designed to serve several hydrologic functions in Phase 2. In existing conditions, sheet flow from 65th Street enters catch-basins north of the road edge and is piped directly, untreated, into Lake Washington. Water that sheet flows from the road and parking areas to the west either enters into this same storm-drain system or it simply enters into the vegetated habitats on the site, untreated. One purpose of the Link Ponds is to provide appropriate water quality treatment to the untreated stormwater that can be 'captured' readily and pre-treat it appropriately, prior to discharging it into the created and enhanced wetland complex, prior to discharging it into the Lake.

To the west of the Link Pond habitat zone it is proposed to construct a filter strip (where space is available) and vegetated conveyance swale or ecology embankment (where space is more constrained) to provide primary treatment of the stormwater runoff from the portion of 65th St that is tributary to the Linked Marshes.

The Link Ponds also serve to link the existing M6 wetland to the 4B Ditch wetland to form a complex of habitat within this zone. The majority of M6 (0.80 acres) will be enhanced through dredging to create longer periods of deeper inundation (12-18 inches), and by removal of invasives and under-planting with appropriate native shrubs and conifers to increase species richness and complexity. The groves of black cottonwood saplings in the existing wetland are to be protected from grading to the extent possible. Storm water in Ditch 4B enters the site from sheet flow off 65th St and Beach Drive, from a culvert to the east underneath Beach Drive, and from a pipe that collects surface runoff in a portion of the existing boat launch parking area. These flows will be combined with flows from the west (via Linked Marsh 1) to form a series of shallow seasonal marshes that flow to the north parallel to Beach Drive. Water will be purely seasonal and due to small anticipated volumes, this wetland complex will likely be one of the first to dry out every spring. Water will leave the Link Marsh wetland complex at the north end, through a storm drain, and

discharge to the same buried 30-inch storm-drain as will the Prom Pt Ponds. Flows will then discharge to the Lake.

Vegetation

It is proposed that the vegetation community types in Polygon M will range from upland forest, wet forest, shrub wetlands, emergent marshes (with annual drying cycle), permanent marsh, and deep aquatic (open water) sites. It will be the most varied habitat area of the Phase 2 project and forms the "heart" of the habitat work.

As noted in previously, the native species identified in Table 7 will be used to create the different plant community palettes proposed for this Polygon (see Sheet L-5.03). Except for the trail overlooks and some of the proposed water-quality treatment road-shoulders, there are no meadow or grasslands proposed in this area.

Wetlands that are seasonally inundated will be seeded with native emergent species that form thin-stemmed persistent vegetation for use for amphibian breeding and bird food sources. The Marsh Ponds and the Link Ponds are proposed to be these types of wetlands: inundated in the fall through the winter, slowing drying out in late spring. Native sedges, rushes, bulrushes will be seeded to predominate the community. The margins of the Marsh Ponds will be live staked with willow, black cottonwood in some locations, and red osier dogwood. It is not proposed to surround these marshes with forested communities immediately because the shade would limit the emergent vigor and tannins from leaf drop can strongly influence the success of invertebrate production (Dennis Paulson, pers comm.). It is expected that even if no black cottonwoods were live-staked, they would still become established over time in this habitat type (as demonstrated by the presence of the trees and saplings in existing conditions in the Park).

Surrounding the Link Ponds and Promontory Ponds however, it is proposed to install sapling trees of early seral stages (e.g., black cottonwood, red alder, Douglas fir, Ponderosa pine, western white pine etc.) and where a closed sapling/shrub canopy already exists, to install later seral saplings (e.g., red cedar, hemlock Sitka spruce, grand fir, Pacific yew, etc.). It is intended to create upland and wetland forest habitats in the zones surrounding the wetlands to provide visual barriers to human intrusion, to create physical complexity for a variety of life stages of various wildlife species, and to shield aquatic habitats from noise and light, as is feasible.

Promontory Point Ponds will have emergent marsh in the shallow embayments within each pond. They are also designed to have deeper aquatic habitat to preclude total vegetated cover within the wetland. The convoluted margins are proposed to increase the linear footage of “edge” habitat, and to provide the opportunity to create forested zones on the peninsulas to provide shade and structure to the adjacent wetlands. It is intentional that the emergent habitats within the shaded portions of the Prom Pt Ponds will have a different species component than the brighter sunnier Marsh Ponds.

A significant portion of the zone between the two Promontory Point Ponds is designed to be within one foot elevation of the permanent water surface elevation of the ponds. It is expected that capillary fringe influence will allow the establishment of a shrub/sapling forest community in this interior location. Early seral stage trees and shrubs will be installed within this expected capillary zone. Above that elevation, an upland mesic/moist forest will be installed as a sapling stage of early seral stage species.

The Link Ponds will be similar in composition to the Marsh Ponds, however it is assumed that they will dry out sooner in the spring (less water in the system and overall shallower depths). Therefore they will be seeded with an emergent mix that has the tolerance for a broader range of hydroperiod and more prolonged drying out.

5.4 Upland Forest

As noted in the preceding text, upland forest is proposed for much of the ‘in-between’ habitats of the site. Most of the proposed upland forest will be installed as early seral stage moist/mesic saplings and shrubs. This would include species such as red alder, big leaf maple, Douglas fir, grand fir, Ponderosa pine, western white pine for the canopy. Red alder would likely be a dominant at installation and for the first 5-10 years, based on its ability to prepare newly exposed soils for subsequent species. Concern is sometimes raised about creating monocultures of red alder, however the Performance Standards lay out an expected sequence of dominance and species richness shifts per community types over time to address this concern.

For west and south slopes on the site it is proposed to install dry upland forests. These areas will be drier than our native moist forests tolerate, therefore it is proposed to use native species but from drier aspect palettes. Dry sunny forests on these slopes will include canopy species such as Ponderosa pine and Garry oak; two species native to the Puget Trough but not necessarily historically found on this site. Created conditions on the site will have physical parameters that will not be conducive for moist/shade preferring native forest species.

Sapling stage trees will be installed at the time of construction, it is anticipated that forest conditions will only develop on newly installed communities over time. It is expected that within 10 years saplings of red alder and cottonwood will function like mature shrubs: closed canopy, accumulation of leaf litter, beginnings of self-selection by vigor. It is assumed that it will take at least 25 years for tree saplings to begin to provide tree/forest functions.

Within all the forest communities' large woody debris, brush piles, and rock piles will be created to provide physical complexity on the ground, micro-habitats, and perch/refuge sites.

5.5 Replacement Ratios

Replacement ratios for wetland impacts are an inexact process, as recognized in Volume 2 of the Synthesis of the Science documents from Ecology. Factors such as the condition of the wetlands being impacted, the condition of the lands identified for the compensation (e.g., the presence and extent of invasives species), the likelihood of appropriate and effective long-term maintenance and monitoring, and the assurance of adequate hydrology to support future proposed habitats are all variables that should be considered in assigning replacement ratios. In Volume 2 of Wetlands of Washington, Synthesis of the Science (Ecology 2005), Table 8C-11 of Appendix 8-C presents a summary of recommended replacement ratios. The text identifies that these ratios should be considered as a 'starting place' in the discussion of replacement ratios to determine compensation acreages for a project. Table 8C-11 of the Volume 2 document is provided as Appendix C of this report.

For Phase 2 direct impacts, wetland compensation is proposed at the ratios as described in App. 8-C of the Ecology document. All the wetlands to be impacted are Category III wetlands, except for C1 which is a Category IV, (City of Seattle/Ecology rating system). The Ecology compensation guidelines suggest a range of compensation ratios depending upon the approach for compensation that is proposed. For "straight" creation or rehabilitation of Category III wetlands, the Ecology ratio is 2:1 (two acres of compensation for each acre of impact). When creation/re-establishment is coupled with enhancement, the creation/re-establishment ratio goes down to 1:1. To compensate for impacts to Category III wetlands with just enhancement, Ecology recommends a 4:1 ratio, however, coupled with creation/re-establishment, the enhancement ratio shifts downward to 2:1. City of Seattle ratios are 2:1 at the time of this writing, although they may be changed to Ecology's suggested ratios (R. Knable, pers. com.).

For the direct impacts anticipated in Phase 2, Table 9A identifies proposed compensation acreages by enhancement of existing wetlands and Table 9B identifies the proposed compensation acreages provided by creation/re-establishment. Assuming a replacement ratio of 4:1 for enhancement of existing wetlands, the Phase 2 enhancement actions would compensate for 1 acre of wetland fill. Assuming a replacement ratio of 2:1 for creation/re-establishment of wetlands, Phase 2 actions would provide 5.02 acres of compensation. Therefore the compensation actions would meet the Ecology standards for the anticipated direct impacts to wetlands in Phase 2.

Table 9A: Compensation Acreage Provided by Enhancement

Wetland	Enhancement		Area of Compensation Provided	
	Square foot	Acres	Ratio	Acres
B1	21,744	0.50	4:1	0.12
B4	10,686	0.25	4:1	0.06
E1	50,560	1.16	4:1	0.29
E2	11,591	0.27	4:1	0.07
M1	14,336	0.33	4:1	0.08
M2	13,469	0.31	4:1	0.08
M5	14,744	0.34	4:1	0.08
M6	34,678	0.80	4:1	0.20
Total	174,753	4.01		1.00

Table 9B: Compensation Acreage Provided by Creation

	Creation		Area of Compensation Provided	
	Square foot	Acres	Ratio	Acres
Poly B	47,977	1.10	2:1	0.55
	43,064	0.99	2:1	0.49
Poly E	9,191	0.21	2:1	0.11
	2,247	0.05	2:1	0.03
Poly M	13,469	0.31	2:1	0.15
	294,576	6.76	2:1	3.38
	15,930	0.37	2:1	0.18
	11,129	0.26	2:1	0.13
Total	437,583	10.05		5.02

5.6 Functions of Proposed Wetland Communities

Wetland functions were estimated in future conditions in Phase 2 using the WFAM (Ecology) method for western Washington; the results are provided below in Table 10. Although the WFAM is not designed to compare existing/proposed conditions, (T. Hruby, pers. com.), a comparison does allow one to understand how some shifts in physical conditions may influence functions in future conditions. Appendix E lists the assumptions used in evaluating functions in the proposed wetlands. Because there are a range of proposed changes in wetland size, hydroperiod, species richness, community interspersion, physical complexity, and fragmentation, there will be a range of shifts in expected functions. Proposed actions will result in an estimated improvement in some functions, and also an estimated decrease in other functions based on the assumptions built into the WFAM.

Changes in hydroperiod to deeper inundation for longer durations, an increase in vegetation species richness, an increase in community complexity and structural complexity (e.g. LWD, brush piles, rock piles, etc.), and an improvement in habitat fragmentation will influence habitat function. Using the WFAM, functions for some wildlife guilds (e.g., invertebrates and aquatic birds) will decrease in some habitats with a shift from PEM to PSS/PFO habitats over time. There will be an increase in functions in areas with increased hydroperiods (depths & duration), stable water levels, and appropriate vegetation structure for waterfowl, amphibian breeding, and invertebrates.

Change in water quality function is variable, depending upon the assumed HGM class, vegetation conditions, outlet configurations, and residence time. Removal of sediment is expected to increase with increased residence time accompanied by dense vegetative cover. Uptake of toxics and heavy metals is estimated to decrease, using WFAM, due to a proposed shift from grassed wetlands to shrub/forest communities. In real terms, it is expected that removal of 12 acres of impervious surfaces will have a positive influence on water quality. In addition, day-lighting a buried storm drain and running the flows through a 1,000+ feet of wetland will provide a measurable increase in water quality over existing conditions, regardless of what the WFAM model assumes.

Water quantity functions are generally assumed to improve over existing conditions due to the increased residence time, creation of broad, unconstricted outlets that will not cause downstream erosion, and an increase of 10 additional acres of wetland on the site. In addition to the changes in the wetland communities, the upland areas immediately surrounding all the wetlands will be planted in upland forest communities. For the functional assessment vegetation conditions were assumed 10 years after planting, meaning that trees are assessed as sapling/shrub stage. However, the establishment of forest communities will have a very significant benefit and shift in habitat functions for a wide range of wildlife guilds over time.

Table 10: Functions of Proposed Wetlands

Wetland Function Category	Wetland Function	Entry Marsh	E1	E2	Marsh Ponds	Promontory Pt Ponds	Linked Marsh
Water Quality Functions	Removing Sediment	6	3	4	5	7	6
	Removing Nutrients	5	2	3	5	5	5
	Removing Heavy Metals & Toxic Organics	7	4	4	6	6	5
Water Quantity Functions	Reducing Peak Flows	4	4	3	4	8	6
	Reducing Downstream Erosion	5	5	5	5	6	7
	Recharging Groundwater	6	1	2	6	3	4
Habitat Suitability Functions	General Habitat Suitability	3	5	3	5	5	5
	Suitability for Invertebrates	3	4	3	4	5	3
	Suitability for Amphibians	1	1	1	2	4	2
	Suitability for Anadromous Fish	1	1	1	2	4	1
	Suitability for Resident Fish	2	1	1	3	6	2

Wetland Function Category	Wetland Function	Entry Marsh	E1	E2	Marsh Ponds	Promontory Pt Ponds	Linked Marsh
	Suitability for Aquatic Birds	3	4	3	4	6	4
	Suitability for Aquatic Mammals	1	2	1	3	5	1
	Native Plant Richness	3	5	2	5	4	5
	Primary Production and Export	8	5	4	8	6	7

6.0 GOALS, OBJECTIVES, AND PERFORMANCE STANDARDS

The goals for any compensation plan outline what is expected and anticipated for the project over time. The objectives describe how the goals are to be achieved. The performance standards are the 'measuring sticks' used to determine if the goals are being met, or if conditions are in place to ensure that the goals will be met over time. Each performance standard should be linked back to one more of the goals. Goals are by definition, broadly described expectations. Objectives are the actions necessary to achieve or implement the conditions necessary to achieve the goals. The performance standards are precise and quantifiable, and are tied to a time frame to ensure actions lead to the desired outcomes within a pragmatic and effective time frame. Described below are the goals and objectives for habitat parameters for the Phase 2 project. Following those are the Performance Standards.

6.1 Goals and Objectives

The goals for the habitat parameters of the proposed project are:

- to preserve the hydroperiod of existing wetlands that are to remain unaltered on the site and maintain the general movement of water across the site;
- enhance the functions of some of the wetlands within the project area through passive and active means such as increasing the depth/duration of hydroperiods, increasing native species richness, removing and controlling invasives, increasing physical complexity, and improving conditions in adjacent habitats;
- maintain or improve the physical connectivity between habitats on the site;
- create new wetlands with a diversity of vegetative communities and HGM-types out of existing low-quality upland habitats;
- improve water quality conditions of runoff draining into Lake Washington by removing 12 acres of impervious surface and appropriately treating stormwater runoff from some paved surfaces which is untreated under existing conditions;
- provide improved access for education and passive interpretation of the various habitats and water features in the project area.

Goal #1: Preserve hydroperiod of remaining wetlands and water movement across the site.

- Objective 1.1: Analyze the existing sub-basins of the project area and ensure that future conditions will replicate existing water movement patterns across the site;
- Objective 1.2: Design the grading of the site to ensure that unaltered wetlands will retain an appropriate source of water to maintain a hydroperiod that will sustain the existing or proposed vegetation communities;
- Objective 1.3: Design the movement of water across the site so that general patterns will be maintained and that water exiting the project area will replicate existing conditions.

Goal #2: Enhance the functions of wetlands and uplands to remain in the project area.

- Objective 2.1: Passively increase the duration and depth of inundation of some existing wetlands through means such as back-watering or increased volume of input to shift the hydroperiod to support a community of more wet-tolerant native plant species;
- Objective 2.2: Actively change the hydroperiod of existing wetlands through shallow to moderate grading to create areas of deeper inundation for longer duration to improve native vegetation conditions;
- Objective 2.3: Improve native species richness, diversity, and physical complexity by seeding and installing native species in all habitat types to be enhanced. Installation methods include seeding, plugs, live stakes, bare-root or potted emergents, shrubs, or trees. Choose species based on the appropriate successional stage of the community (e.g., under-plant existing shrub/sapling zones with later seral stage coniferous species);
- Objective 2.4: Remove and control non-native plants (invasives and non-invasive species) through physical removal and active management, changes in hydroperiod to create inappropriate growth conditions, and/or over-planting of native species;
- Objective 2.5: Create physical complexity on the forest floor for habitat improvements through placement of LWD, brush piles, and rock piles in all habitat within the Phase 2 area;
- Objective 2.6: Reduce the numbers and locations of informal foot paths throughout the habitat zone of the Phase 2 area to reduce human and dog contact with habitats.

Goal #3: Improve habitat linkages within the Project Area and adjacent habitats

- Objective 3.1: Maintain, to the extent feasible, all the groves of existing native shrubs, saplings and trees within the Project Area;
- Objective 3.2: Create upland forest habitat around the perimeter zones of the Project Area to link the interior habitats with existing upland habitats outside of the limits of the Phase 2 project area;
- Objectives 3.3: Provide physical complexity on the forest floor with LWD, brush piles, rock piles within all the terrestrial habitats for wildlife refuge;
- Objective 3.4: Under-plant existing closed canopy treed communities with appropriate later seral stage woody species to facilitate successional stages.

Goal #4: Create new wetlands from low-quality upland habitats

- Objective 4.1: Remove the roots and/or root mass of non-native invasives such as Himalayan blackberry, Scott's' broom, and reed canary grass to improve long-term success of establishing appropriate plant communities;
- Objective 4.2: Create wetland hydroperiods by grading to form zones of long-term inundation at depths that will promote the growth of obligate wetland plant species;

- Objective 4.3: Create saturated soil conditions by creating zones of long-term saturation through inundation and/or capillary fringe actions in amended soils to promote the growth of wetland shrubs and trees;
- Objective 4.4: Install native seeds, plugs, shrubs, saplings, and live stakes in areas of appropriate wetland hydroperiods to create diverse communities of native species;
- Objective 4.5: Create physical complexity on the forest floor through placement of LWD, brush piles and rock piles throughout the created wetland areas.

Goal #5: Improve water quality of runoff discharged into Lake Washington

- Objective 5.1: Remove 12 acres of impervious surface in the Phase 2 project area;
- Objective 5.2: Provide appropriate state-of-the-art pre-treatment for portions of the existing untreated stormwater currently being discharged to Lake Washington;
- Objective 5.3: Daylight an existing buried storm-drain pipe, pre-treat the stormwater, and then run it through over 2,000 linear feet of created and enhanced wetland habitats prior to discharging to an existing storm-drain pipe leading to Lake Washington.

Goal #6: Create the infrastructure for active and passive education opportunities

- Objective 6.1: Design the trail system to allow for ease of access to a variety of upland and aquatic habitats for viewing, data collection, over-views, and observing wildlife;
- Objective 6.2: Provide appropriate locations for students of multiple ages to have ready access to a range of aquatic features and stormwater treatment-trains for collecting water samples;
- Objective 6.3: Design the trail system that provides ADA access to a broad range of habitat types, including elevated locations for over-views, without creating human intrusions into all habitats in the Phase 2 project area.

6.2 Performance Standards

Performance standards are tools used to determine if goals are being met or if the parameters are in place for goals to be met over time. The most recent mitigation guidance document from Ecology/COE/EPA (Ecology 2004b) states:

> *"Performance standards describe a desired state, threshold value, or amount of change necessary to indicate that a particular function is being performed or structure has been established."*

From a practical standpoint, performance standards have to be correlated to the stated goals of a project in order for anyone to evaluate if the project is achieving its stated goals. Performance standards must also establish the indicator to be measured and they must establish a timeframe for establishment. In general, measurable indicators include vegetation, water or evidence of water, physical structures or conditions, and/or infrastructure. The following Performance Standards are organized relative to the Goals and objectives outlined above. Therefore, one can trace what physical indicators or actions are proposed to implement and eventually obtain the Goals. Because of this organizational approach, the Performance Standards contain a certain amount of repetition for various vegetation community types, and even between uplands and wetland habitats. Plant species are assumed to be those listed on Table 7, provided earlier in this document.

The assumptions for the Performance Standards are provided here:

Water regimes:

- permanent water deeper than 5 feet will not be vegetated;
- seasonal inundation of a few inches to 18 inches that fully dries out every year by mid-spring will not become completely dominated by cattails;
- areas within 1 foot of elevation of long-term or permanent inundation will develop soil saturation within the top 12 inches from the actions of capillary fringe
- areas that are inundated or saturated for more than 12.5 percent (30 consecutive days) of the growing season (between March 1 and October 31) will, over time, develop wetland soil characteristics.

Vegetation structure development:

- live stakes will be planted at higher density than rooted plants and will not be held to a survival performance standard because a higher mortality is assumed;
- rooted trees and shrubs will have a 100 percent survival within the first year if they are bid with a one-year guarantee period;
- tree and shrub plantings will be done in naturalistic mixed clusters with 2-3 species of trees and 4-6 species of shrubs. For species richness determination, it is assumed that at least 2 species of trees and 4-5 species of shrubs will remain/establish within the community within the first 3 years, and that can include appropriate volunteers;
- tree and shrub aerial coverage shall be 40-50% by year 3, 50-75% by year 5, and 100% by year 10;
- for species diversity determination it is assumed that no single species should constitute more than 50% of the total aerial coverage after 3 years, unless it is a purposeful pioneering species such as red alder used to establish appropriate early seral stage conditions;
- appropriate native volunteers can be counted for determination of richness;
- emergent plants will be installed by seeding rather than live plants, except in zones where no grading is proposed and passive backwatering is to be used to change the hydroperiod; in those settings plugs will be used;
- emergent species richness should consist of at least four species including appropriate native volunteers after year 3, with a 45-60% aerial coverage.

Invasive species

- invasive species such as Scott's broom and Himalayan or evergreen blackberry will be assumed to be 'controllable' and a standard of 100% removal within the project area is assumed by year 5;
- invasives which are rhizomatous or spread by seed (e.g., reed canary grass) do not have a 100% removal goal in five years due to the high probability that it is not achievable. Reed canary grass root masses will be removed by grading or will be over-planted with native shrubs and trees and expected to diminish over time.

Table 11: Performance Standards

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
Goal #1: Preserve hydroperiod	Obj. #1.1	Analyze the existing sub-basins	Identification of generalized pattern of water movement across the site in pre-existing conditions	Design report	pre-construction	N/A
	Obj. #1.2	Design grades	Approved grading plans	Peer review of site grading designs	NA	Modify designs based on review input
	Obj. #1.3	Grade site	Completion of site grading	Preparation of as-builts to confirm site construction reflected approved designs. Construction modifications documented with change-order approvals from design ecologist and agency staff.	Complete at end of Year 2 construction	Modify grades, elevations as necessary to achieve appropriate water movement and control erosion
Goal #2: Enhance Existing Wetland and Upland Habitat Functions	Obj. #2.1	Increase depth and duration of inundation passively	Through backwatering or increased volumes of input, create a minimum of 12 inches of inundation for a minimum of 5 consecutive months/year[1]	• Staff gages in all enhanced wetland habitats designed for inundation • Placement of piezometers in existing or proposed wetlands with saturation, to document hydroperiod	Once/month for December 1 – April 1; Annually years 1,2,3,5,7,10.	• Increase depths of inundation by raising outlets • Diminish permeability of leaky berms or other non-fixed outlets
Goal #2: Enhance Existing Wetland and Upland Habitat Functions	Obj. #2.2	Increase depth and duration of inundation through grading	Create impounded water levels of a minimum of 16 inches for a minimum of 5 consecutive months/year	Staff gages in all enhanced wetland habitats designed for inundation	Once/month for December 1 – April 1; Annually years 1,2,3,5,7,10.	• Deepen the excavation to increase depths of inundation • Restrict size of outlets to increase volume of retention

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
Goal #2: Enhance Existing Wetland and Upland Habitat Functions	Obj. 2.3	Enhance 4 acres of native species richness and physical complexity	Emergents: minimum of 4 species/community present, no one species constitutes more than 50% presence in the wetland.	Stem count in 1 m. plots; richness and diversity parameters attributed to the wetland as a whole (not per plot). Native volunteers can be included as appropriate	By August 1 of each year; Annually years 1,2,3,5,7,10.	• Determine causes of species failure • Install plug, seed, live stake, bare-root or potted material (as appropriate) of additional plants. May substitute other hydrologically appropriate species. • Increase management of invasives or competitive species. • Provide temporary irrigation in unexpected drought early in establishment period.
	Obj. 2.3		Shrubs: live stakes of 2-3 species installed at 3 foot on center. When live stakes are intended for shading of reed canary grass, densities shall be increased to 2 feet on center.	Stem count of 80% survival in 5 meter plots for years 1 and 2. Aerial coverage and vigor in years 3,5,7, and 10. Aerial coverage will be 25% (year 3), 50% (year 5) and >70% by year 7. For shading densities: aerial coverage should be >50% by year 3 and >70% by year 5.	By August 1 of each year; Annually years 1,2,3,5,7,10.	
Goal #2: Enhance Existing Wetland and Upland Habitat Functions	Obj. 2.3		Shrubs: bare-root or pots installed in clusters averaging 3-4 feet/center;	Stem count of 80% survival in 5 meter plots for years 1 and 2. Aerial coverage and vigor in years 3,5,7, and 10. Aerial coverage will be 25% (year 3), 50% (year 5) and >70% by year 7. For shading densities: aerial coverage should be >50% by year 3 and >70% by year 5.	By August 1 of each year; Annually years 1,2,3,5,7,10.	

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
Goal #2: Enhance Existing Wetland and Upland Habitat Functions	Obj. 2.3		Trees: live stakes of black cottonwood installed at 5-7 foot on center. For shading non-native invasives, installation densities of 3-5 feet/center and anticipate higher mortality over time.	Stem count of 80% survival in 10 meter plots for years 1 and 2. Aerial coverage and vigor in years 3,5,7, and 10. Aerial coverage will be 20-30% (year 3), 50-60% (year 5) and >70-100% by year 7. For shading densities: aerial coverage should be 50-60% by year 3 and 70-100% by year 5.	By August 1 of each year; Annually years 1,2,3,5,7,10.	
Enhance Existing Wetland and Upland Habitat Functions	Obj. 2.4	Control invasives	Removal and effective control of non-native invasive species to the following standards: <u>Himalayan/evergreen blackberry</u> removed by year 3 to a less than 10% presence in Phase 2 project area; <u>Scott's broom:</u> 100% removed by year 3 in Phase 2 project area; <u>Japanese knotweed</u>: 100% removal by year 3 in Phase 2 project area; <u>Reed canary grass</u>: over-planted in 100% of the areas of presence by year 2. Reduction in vigor and stem density in areas of over-planting by Year 5 in Phase 2 project area; Lombardy popular: 100% removed by end of Year 2.	For all invasives, patches will be identified in as-builts or at 1st year monitoring. Monitoring plots focused on the existing or former invasive patches will be sized to include the entire patch. Patches will be monitored to watch for re-sprouting or recolonization of managed species. The entire Phase 2 area will be monitored annually for the re-establishment of patches of invasives to provide for rapid maintenance removal activities.	Monitoring for all invasives will occur twice/year for the first 3 years. Early growing season (prior to June 30) and late growing season (by August 30) to assure rapid maintenance actions can be undertaken to control plants. After year 3 monitoring may be reduced to once/year (years 3-5, 7, 10 in spring) depending upon presence.	• Increased monitoring frequency to allow faster maintenance action response time; • Re-grubbing of roots, re-application of sheet mulch, re-application of wood chips • Active mowing between clumps/rows of woody plants to reduce above-ground stock of reed canary grass
Goal #2:	Obj.	Create	At the end completion of	Document with As-builts the	Annually at the time of	• Augment brush piles with

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
Enhance Existing Wetland and Upland Habitat Functions	2.5	physical complexity on the ground	installation, there will be an average of 4 -6 /acre of habitat 'structures' in any habitat in the Phase 2 area. Habitat structures may include brush piles, LWD, rock piles. Brush piles should be a minimum of approx. 5X5 feet high X 3-4 feet high at installation; LWD will be no less than 8" diameter at the smallest end, and no less than 3 feet long; rock piles will be no smaller than 3X3 feet and avg. of 2 feet high. Rocks should be an average of 4-6 inches minimum in 'diameter' with the intent to form a pile with substantial spacing between/underneath rocks for refuge.	location and approximate dimensions of brush piles, LWD, and rock piles. Note presence, dimensions, locations, and provide photo-documentation. Note evidence of use (trails in/out, scat, droppings, grazing, or observed perching activity) at time of annual summer vegetation monitoring.	the second vegetation monitoring in late summer; Years 1,2,3, 5,7, 10.	additions if they become too compressed or diminished over time. • Add additional pieces of LWD if ones are too decomposed or use indicates need for more; • Replenish rock piles or remove invasives (blackberry) which may establish in them.
	Obj. 2.6	Reduce amount of trails in habitat area	Block access, eliminate, and post informational signage on all informal trails through the habitat area that are noted for removal by end of Year 2 of construction.	Confirm condition of barriers, informational signage, and trail conditions.	Coincide with twice/annually vegetation monitoring for Years 1,2,3,5,7,10.	• Reinstall effective barriers; • Post additional signage • Deconstruct trails through ripping of soils and replanting with un-inviting plant (e.g. Wild rose).
	Obj. 2.7	Provide opportunities for breeding wildlife such as birds, amphibians	Birds: No specified performance standard	• Christmas bird counts to assess species diversity and densities • On-going monthly birding data collection from	Annually for the Christmas bird count (one day). Monthly on an informal basis by Seattle Audubon volunteers.	None suggested

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
		and macroinvertebrates.		Audubon Society		
			Amphibians: Qualitative assessments of population densities will not show declines	• Frog-Watch qualitative data from volunteers during breeding season • Egg mass counts, during breeding season • Larval/adult sampling using various non-invasive trapping techniques after breeding season	• Egg mass monitoring would occur starting in February of the first year after installation. Depending upon vegetation development, breeding for amphibs and macroinverts may take several years to establish in newly modified habitats. Annually for Years 1-10.	Inoculation of larval amphibians into appropriate habitat after establishment of appropriate aquatic plant community to facilitate amphibian survival and reproduction
			Macroinvertebrates: Index of Biological Integrity falls within an appropriate reference range	Dip net sweeps and Hester-Dendy plate sampling	• Dip-net sweep sampling monthly from April-September • Hester-Dendy plate sampling for three weeks in June • Annually for Years 1-10.	Establishment of appropriate aquatic plant community to facilitate macroinvertebrates survival and reproduction
Goal #3: Improve habitat linkages	Obj 3.1:	Maintain existing stands and groves of trees	Document location and approximate boundaries, and composition of existing groves of trees and saplings within the Project Area that are identified for protection.	Once/year document with photographs from photo points, fixed locations.	Once/year in late summer for years 1,2,3.	Groves will be augmented or replanted if they are damaged during site construction.
Goal #3: Improve habitat linkages	Obj.3.2:	Create upland forested buffers	Shrubs: bare-root or pots installed in clusters averaging 3-4 feet/center; For shrubs aerial coverage will be 25% (year 3), 50% (year 5) and >70% by year	Stem count of 80% survival in 10 meter plots for years 1 and 2. Use aerial coverage and vigor in years 3,5,7, and 10.	By August 1 of each year; Annually Years 1,2,3,5,7,10.	See objective 2.3 above.

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
			7. Trees: bare-root or installation densities of 510 feet/center. Trees and shrubs planted in naturalistic mixed clusters. For the trees, aerial coverage will be 20-30% (year 3), 50-60% (year 5) and >70-100% by year 7. Clusters will have a minimum of 3 species of trees and 4 species of shrub.			
Goal #3: Improve habitat linkages	Obj. 3.3	Create physical complexity on the ground	At the end completion of installation, there will be an average of 4 -6 /acre of habitat 'structures' in any habitat in the Phase 2 area. Habitat structures may include brush piles, LWD, rock piles. Brush piles should be a minimum of approx. 5X5 feet high X 3-4 feet high at installation; LWD will be no less than 8" diameter at the smallest end, and no less than 3 feet long; rock piles will be no smaller than 3X3 feet and avg. of 2 feet high. Rocks should be an average of 4-6 inches minimum in 'diameter' with the intent to form a pile with substantial spacing between/underneath rocks	Document with As-builts the location and approximate dimensions of brush piles, LWD, and rock piles. Note presence, dimensions, locations, and provide photo-documentation. Note evidence of use (trails in/out, scat, droppings, grazing, or observed perching activity) at time of annual summer vegetation monitoring.	Annually at the time of the second vegetation monitoring in late summer; Years 1,2,3, 5,7, 10.	• Augment brush piles with additions if they become too compressed or diminished over time. • Add additional pieces of LWD if ones are too decomposed or use indicates need for more; • Replenish rock piles or remove invasives (blackberry) which may establish in them.

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
			for refuge.			
Goal #3: Improve habitat linkages	Obj. 3.4:	Initiate late seral stage plantings	Installation of later seral stage conifers at 10-14 foot-on-center avg. in upland forest habitats by end of Year 4. Survival of 80% of installed material by 3 years-post-installation.	Stem count of 80% survival in 10 meter plots for years 1 and 2. Use vigor in years 3,5,7, and 10. Take annual photo points.	By August 1 of each year; Annually years 1,2,3,5,7,10.	
Goal #4: Create new wetlands	Obj. 4.1	Remove the roots or root mass of non-native invasives	Grading to remove the root masses of existing invasives by grading a minimum of 18 inches through patches of invasives. Physical removal of root balls of trees or vigorous canes.	Data collection and photo points to document removal success.	Monitoring for all invasives will occur twice/year for the first 3 years. Early growing season (prior to June 30) and late growing season (by August 30) to assure rapid maintenance actions can be undertaken to control plants. After year 3 monitoring may be reduced to once/year (years 3-5, 7, 10 in spring) depending upon presence.	
Goal #4: Create new wetlands	Obj. 4.2	Create long-term inundated wetland hydroperiods	Create impounded water levels of a minimum of 16 inches for a minimum of 5 consecutive months/year	Staff gages in all created wetland habitats designed to have long-term inundation	Once/month for December 1 – April 1; Annually years 1,2,3,5,7,10.	• Deepen the excavation to increase depths of inundation • Restrict size of outlets to increase volume of retention
Goal #4: Create new wetlands	Obj. 4.3	Create saturated soil conditions	Create saturated soils within 12 inches of the surface for a minimum of 5 consecutive months/year	Placement of piezometers in areas of created wetland	Once/month for December 1 – April 1; Annually years 1,2,3,5,7,10.	• Additional organic soil augmentation to facilitate capillary action • Modify outlet on

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
						wetland to prolong adjacent inundation to influence saturation
Goal #4: Create new wetlands	Obj. 4.4	Create 10 acres of wetland habitats	Emergents: a minimum of 4 species/community present, no one species constitutes more than 50% presence in the wetland.	Stem count in 1 m. plots; richness and diversity parameters attributed to the wetland as a whole (not per plot). Native volunteers can be included as appropriate	By August 1 of each year; Annually years 1,2,3,5,7,10.	• Determine causes of species failure • Install plug, seed, live stake, bare-root or potted material (as appropriate) of additional plants. May substitute other hydrologically appropriate species. • Increase management of invasives or competitive species.
Goal #4: Create new wetlands			Shrubs: live stakes of 2-3 species installed at 3 foot on center. When live stakes are intended for shading of reed canary grass, densities shall be increased to 2 feet on center.	Stem count of 80% survival in 5 meter plots for years 1 and 2. Aerial coverage and vigor in years 3,5,7, and 10. Aerial coverage will be 25% (year 3), 50% (year 5) and >70% by year 7.	By August 1 of each year; Annually years 1,2,3,5,7,10.	
Goal #4: Create new wetlands			Shrubs: bare-root or pots installed in clusters averaging 3-4 feet/center;	Stem count of 80% survival in 5 meter plots for years 1 and 2. Aerial coverage and vigor in years 3,5,7, and 10. Aerial coverage will be 25% (year 3), 50% (year 5) and >70% by year 7. For shading densities: aerial coverage should be >50% by year 3 and >70% by year 5.	By August 1 of each year; Annually years 1,2,3,5,7,10.	
Goal #4: Create new wetlands	Obj. 4.4	Create 10 acres of wetland habitats	Trees: live stakes of black cottonwood installed at 5-7 foot on center. For shading non-native invasives, installation densities of 3-5 feet/center and anticipate higher mortality over time.	Stem count of 80% survival in 10 meter plots for years 1 and 2. Aerial coverage and vigor in years 3,5,7, and 10. Aerial coverage will be 20-30% (year 3), 50-60% (year 5) and >70-100% by year 7.	By August 1 of each year; Annually years 1,2,3,5,7,10.	
Goal #4: Create new wetlands	Obj 4.5	Create physical complexity	At the end completion of installation, there will be an average of 4 -6 /acre of	Document with As-builts the location and approximate dimensions of brush piles,	Annually at the time of the second vegetation monitoring in late	• Augment brush piles with additions if they become too compressed or

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
		on the ground	habitat 'structures' in any habitat in the Phase 2 area. Habitat structures may include brush piles, LWD, rock piles. Brush piles should be a minimum of approx. 5X5 feet high X 3-4 feet high at installation; LWD will be no less than 8" diameter at the smallest end, and no less than 3 feet long; rock piles will be no smaller than 3X3 feet and avg. of 2 feet high. Rocks should be an average of 4-6 inches minimum in 'diameter' with the intent to form a pile with substantial spacing between/underneath rocks for refuge.	LWD, and rock piles. Note presence, dimensions, locations, and provide photo-documentation. Note evidence of use (trails in/out, scat, droppings, grazing, or observed perching activity) at time of annual summer vegetation monitoring.	summer; Years 1,2,3, 5,7, 10.	diminished over time. • Add additional pieces of LWD if ones are too decomposed or use indicates need for more; • Replenish rock piles or remove invasives (blackberry) which may establish in them.
Goal 5: Improve water quality runoff in Lk WA	Obj. 5.1	Remove 12 acres of impervious surface	Remove 12 acres of existing impervious surfaces from the Phase 2 project area and dispose of the material appropriately.	Document with As-builts and photographs removal of materials	End of demolition stage of construction. Include in annual monitoring report	If not possible to complete all at once, then remove materials in stages and document % removal to agencies.
Goal 5: Improve water quality runoff in Lk WA	Obj. 5.2	Provide pre-treatment of storm water	Install Catchbasin Stormfilters® by Stormwater Management, Inc. with ZPG (zeolite, perlite, and activated carbon) or create Ecology shoulders and biofiltration swales where appropriate to discharge stormwater into prior to discharging to	Monitor grab samples for the following parameters: • Total phosphorus levels • Total nitrogen compound levels • Dissolved oxygen • Total suspended solids • Fecal coliform bacterial counts	Once/month for Nov. through May for Years 1, 2, 3, 5, 7, and 10 at grab sampling at sites immediately downstream of installed catchbasin outlets. Sites where stormwater enters the wetland complexes, and also at wetland exit	Increase vegetation density within created bioswales/Ecology shoulders

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
			WLs. Grab sample analysis will be compared to acute and chronic Aquatic Life Standards for Washington state, where appropriate.	• Water temperature • Water pH	locations.	
Goal 5: Improve water quality runoff in Lk WA	Obj. 5.3	Daylight storm drainage flows	Constructed wetland complex at the Entrance Marshes that incorporates pretreated stormwater from above on the hillside to the west, within the Park.	Monitor grab samples within the Entrance Marshes for the following parameters: • Total phosphorus levels • Total nitrogen compound levels • Dissolved oxygen • Total suspended solids • Fecal coliform bacterial counts • Water temperature • Water pH	Once/month for Nov. through May for Years 1, 2, 3, 5, 7, and 10 at grab sampling at sites immediately downstream of installed catchbasin outlets. Sites where stormwater enters the wetland complexes, and also at wetland exit locations.	Adjust pre-treatment at catchbasin above the discharge point.
Goal 6: Create Education Opportunities	Obj. 6.1	Design a trail for access that also maintains habitat exclusions	Trail is completed that allows adequate pedestrian movement, eliminates informal portions of the trail and maintains portions of the habitat zones as 'trail-free'.	As-Builts at the completion of construction activities; Photographs of site conditions	One section within the first monitoring report following completion of construction activities. Include photos	If necessary construct trails in phases; remove old trails in phases
Goal 6: Create Education Opportunities	Obj. 6.2	Provide for appropriate active education access	Trail and nodes are located such that students can access water and various habitat types in a manner that does not cause damage to the habitat functions or water quality.	As-Builts at the completion of construction activities; Photographs of site conditions	One section within the first monitoring report following completion of construction activities. Include photos	
Goal 6: Create Education Opportuniti	Obj. 6.3	Provide for ADA access	Portions of trail designed to meet state and federal ADA standards; ADA trails are located to access	As-Builts at the completion of construction activities; Photographs of site conditions	One section in 1st monitoring report. Include photos.	

Goal	Objectives		Performance Standard	Monitoring Activity	Mont. Timing/Duration	Adaptive Mngt Responses
es			water and habitats appropriately.			

[1] In years of normal precipitation levels

7.0 MAINTENANCE PLAN

The maintenance plan for Magnuson Park Phase 2 is based on the adopted Sand Point Magnuson Park Vegetation Management Plan (VMP) (Sheldon & Associates 2001), which DPR staff has been implementing for 5 years. The VMP is available at http://www.cityofseattle.net/parks/magnuson/vmp.htm. It is a comprehensive tool for managing the wide range of habitats present at Warren G. Magnuson Park. The VMP provides explicit directions on a broad range of management topics from how to remove and salvage LWD from invasive Lombardy poplar trees, to how to install, mulch and irrigate new restoration plantings.

The City is suggesting to the reviewing agencies of this Compensation Plan, that the management provisions for the VMP be explicitly required as a condition of the permit approvals for Phase 2. Appendix D of this report contains the VMP Chapter titled 3 Year Establishment Care which as a level of detail that far exceed the standard "maintenance plan" of a typical wetland mitigation plan.

8.0 MONITORING PLAN

The monitoring plan is the tool by which data is collected to determine if the goals are being met as measured by the performance standards. The monitoring program uses the principles of adaptive management to guide monitoring activities. Adaptive management is a process with two key components (Elzinga et al. 1998). One component is that monitoring should only be initiated if opportunities for management change exist. The second component is that monitoring is driven by objectives and the monitoring activities must be designed to determine if the objectives have been achieved. Valid monitoring data is critical to making meaningful management decisions that help the site meet its objectives. Monitoring plans are based on site conditions and plant community development.

The quantified criteria presented as performance standards will be used as the basis for monitoring. Table 11 in the Performance Standards section of this report contains the summary of the parameters that will be monitored. The Table also identifies the adaptive management actions that could be taken for those parameters where such options are pragmatically available. Monitoring methods for plant survival, vegetation coverage, photo-points, water regime, and faunal use that may be used to ensure valid data is collected are described below.

The following parameters are assumed for the Monitoring Plan:

<u>As-Builts</u>

As-built drawings will be prepared at the end of the construction and installation of the Phase 2 project. The As-builts form the basis of the baseline monitoring report, which will be handed in prior to Dec. 1 of the year construction is completed. Construction may take two summer seasons, depending upon the start date the first year of construction. As-builts will contain a topographic survey of the project area, including the built infrastructure such as trails, storm catch-basins, fields, and weirs. All habitat areas would be surveyed in based on topography to determine final size of created areas. Staff gages and piezometer elevations would also be surveyed as well as the permanent photo-points for long-term monitoring.

The as-builts will also contain plant installation notes with quantity lists, species list, condition of plant material (e.g., bare root, container, seed), and timing of installation. Planting installation notes would also be provided.
Locations of habitat features (e.g., brush piles, rock piles, LWD) would also be surveyed in for location.

Hydroperiod

To document the hydroperiod of the wetlands in Phase 2 after construction, data will be collected from staff gages and piezometers installed during construction. In existing conditions, piezometers have not been installed on the site to establish baseline conditions, as the soils are so compacted that very little infiltration occurs on the site, it is predominantly shallow surface waters that sheet flow between hummocks. Staff gages will be installed in all wetlands that will have a permanent or seasonal surface water component. In addition, piezometers will be installed in zones around the margins of inundated wetlands in order to be able to document the presence/absence of saturation within the soils sufficiently to meet the performance standards.

Hydrology data will be collected from December through May of each year, on a monthly basis. Given the conditions of the site an the designs to have little water level fluctuations between storm events, it is not deemed necessary to have continuous reading gages or field data collected on a more frequent basis. Precipitation data will be obtained from NOAA which is located immediately north of the project area, north of Magnuson Park. On-site hydrology data will be correlated to precipitation data on a water-year basis and provided in the annual monitoring report.

Vegetation

Vegetation data is to be collected from a variety of matrices. For live-stakes, vigor and stems/plot will be used rather than a % survival, given the highly variable survival rate for live stakes. It is a commercial landscaping standard to use 100% survival of installed rooted plant material as a 'performance standard'; although this standard may be appropriate or 'bank parking lot' landscape installation, it is not reasonable for acres of plants installed in a wide range of habitat and soil conditions. However, expecting that the standard was expected by reviewers, we have maintained it for those plants that are bid with that provision. For all other live rooted plants we've used a standard of 80% survival after 3 years which is a reasonable expectation on such a large project.

Beyond survival, plant vigor as measured as aerial coverage is proposed as one major metric for monitoring. Aerial coverage estimates over a time frame are challenging 'guesses', dependent upon soils, hydrology, plant condition, herbivory, mulch conditions, etc. We have provided ranges of aerial coverage at targeted years (3, 5,7, and 10) for trees and shrubs. We have also included a metric for plant richness and diversity (the number of species and the relative percent presence of species, respectively). As noted, the aerial coverage estimates are an inexact science, and we will also include qualitative assessments of plant vigor, recolonization, grazing or herbivory effects, etc. to our assessment of vegetation community health.

Wildlife

Because of the strong public interest at Magnuson Park in the local populations of Pacific chorus frogs we have also included matrices for their breeding in the newly created and enhanced wetlands as a performance standard. One of the objectives of the habitat work is to create and expand viable habitat for a broad range of prey and predator species: chorus frogs are as good an indicator as any for the health of these wetlands over time.

Reporting

Annual monitoring reports will be prepared and submitted to Ecology, City of Seattle and COE staff annually by December 1st of each year. Year 1 monitoring will occur the first year *after* the completion of construction. As it is unknown if construction will take one or two summer seasons, we have left the initiation of the monitoring schedule open.

It is assumed that monitoring will be required for 10 years on this project by the agencies. We have recommended a reporting schedule of Years 1, 2, 3, 5, 7, and 10. The first three years are critical for maintenance, control of invasives, and establishing the appropriate hydrology and vegetation communities. By year 3 the site should be 'working' appropriately. Years 5 and 7 allow check-ins to assure that no fundamental changes have occurred, that later seral successional plant installation has been successful, and that communities are maturing as predicted. Year 10 provides a look at a quite 'adolescent' habitat area: trees will still be in sapling stages and not yet functioning as forest. However, the site should be well on its way to successful establishment: or the problems will be clear and be under active adaptive management to rectify.

9.0 REFERENCES

Brinson, M.M. 1993. A Hydrogeomorphic Classification for Wetlands. Technical Report WRP-DE-4. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. La Roe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. Office of Biological Services, Fish and Wildlife Service, U.S. Department of the Interior, FWS 1035-79/81. 103 pp.

Ecology et al. 1994. Guidelines for Developing Freshwater Wetlands Mitigation Plans and Proposals. Publication #94-29. Washington Department of Ecology, Washington Department of Fisheries, Washington Department of Wildlife, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and U.S. Fish and Wildlife Service.

Ecology. 2004a. *Washington State Wetland Rating System for Western Washington*. Washington State Department of Ecology Publication No. 04-06-025.

Ecology. 2004b. *Guidance on Wetland Mitigation in Washington State, Part 2*. Ecology, Seattle District Corps of Engineers, EPA Region 10. Publication # 04-06-013B

Ecology. 2005. Volume 2 of Wetlands of Washington, Synthesis of the Science. Washington State Department of Ecology. Publication #04-06-024

Elzinga, C. L. D., W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Hruby, T., T. Granger, K. Brunner, S. Cooke, K. Dublanica, R. Gersib, L. Reinelt, K. Richter, D. Sheldon, E. Teachout, A. Wald, and F. Weinmann. July 1999. *Methods for Assessing Wetland Functions, Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington*. Washington State Department of Ecology Publication #99-115.

Liu, H. S., Mead, J. L., and Stacer, R. G. 1998. "Environmental Impacts of Recycled Rubber in Light Fill Applications: Summary and Evaluation of Existing Literature", Technical Report #2, Chelsea Center for Recycling and Economic Development, Chelsea, MA.

Reed, P.B., Jr. 1988. National List of Plant Species That Occur in Wetlands: Northwest (Region 9). U.S. Fish and Wildlife Service Biological Report. 88 (26.9). 89 pp.

Seattle. 2005. City of Seattle Municipal Code, Chapter 25.09-Regulations for Environmentally Critical Areas. Obtained from website: http://clerk.ci.seattle.wa.us

Seattle Parks and Recreation. 2001. Sand Point Magnuson Master Plan EIS. City of Seattle Department of Parks and Recreation, Seattle, Washington.

Sheldon & Associates, Inc. 2001. Sand Point Magnuson Park Vegetation Management Plan. Prepared for City of Seattle Department of Parks and Recreation. Sheldon & Associates, Inc., Seattle, Washington.

Sheldon and Associates, Inc. 2005a. Magnuson Park, Phase 2—Biological Evaluation, Seattle, Washington. Sheldon and Associates, Inc., Seattle, Washington.

Sheldon & Associates, Inc. 2005b. Letter to U.S. Army Corps of Engineers, Washington Department of Ecology, and City of Seattle regarding wetland delineation methods for Magnuson Park. Sheldon & Associates, Inc., Seattle, Washington.

Sheldon and Associates, Inc. 2005c. Magnuson Park, Phase 2—Wetland Delineation Report, Seattle, Washington. Sheldon and Associates, Inc., Seattle, Washington.

Washington Department of Ecology. 1997. *Washington State Wetlands Identification and Delineation Manual*. Publication No. 96-94.

APPENDIX A
PHOTOGRAPHS

APPENDIX B
PLANT SPECIES OBSERVED ON-SITE

APPENDIX C
ECOLOGY'S COMPENSATION RATIOS GUIDANCE

APPENDIX D
SAND POINT MAGNUSON PARK
VEGETATION MANAGEMENT PLAN 3-YEAR ESTABLISHMENT CARE

APPENDIX E
FUNCTIONAL ASSESSMENT ASSUMPTIONS